```
Set     Items   Description
S1      72401   S VERTEBRA? OR INTERVERTEBRA? OR SPINE? OR (CERVICAL? OR SACRAL? OR
LUMBAR?)(2N)BONE? OR SPINOUS? OR SPINAL? OR INTERSPIN?
S2      69529   S OSTE? OR OSSO? OR OSTO? OR OSSE? OR ENDOSTE? OR PERIOSTE?
S3     129378   S BONE? ? OR ORTHOPED? OR ORTHOPAED? OR OSSEOUS? OR SKELET?
S4      13559   S OSTEAL OR OSTEOID OR OSSEO? OR OSTEOLOG? OR PERIOSTE??? OR OSSIF? OR
FEMUR?
S5      29034   S TIBIA? OR MUSCULOSKELET? OR HUMER? OR FIBULA? OR KNEE? OR PATELLA?
S6     356960   S IMPLANT? OR PROSTHE? OR SHIM???? OR ENDOPROSTHE? OR INSERT? ?
S7     247800   S SPACER? OR EMPLANT? OR INFIX? OR REPLACEMENT? OR OSTEOSYNTHE?
S8      59624   S COVERPLAT? OR COVER()PLATE? OR SHIM????
S9     411746   S ARTIFICIAL? OR SYNTHETIC? OR MANMADE? OR WEDGE?
S10     31271   S S1:S5(20N)S6:S9
S11     27592   S TWO OR PAIR OR BOTH OR DOUBLE? OR TWIN?
S12     10056   S HALF OR HALVE? OR DUPLEX? OR TUPLE?
S13     29887   S 2 OR SIAMESE? OR SECOND? OR 2ND OR DUAD? OR BINARY OR TWOSOME?
S14      5094   S TANDEM? OR DUAL? OR BIFURCAT? OR TWOSOME? OR TWOFOLD?
S15     15659   S DUO OR COUPLE? OR COUPLING? OR MORE(2W)ONE
S16      7975   S COMPLEMENT? OR TONGUE?(2N)GROOV? OR CRENEL? OR CRENNEL?
S17      6227   S MUTUAL?(2N)ENGAG? OR MATE OR MATING OR MATED OR MALE(5N)FEMALE
S18      2059   S FORMFIT? OR DOVETAIL? OR INTERLOCK? OR MORTISE?(2N)TENON?
S19     15910   S INTERCONNECT? OR MESH? OR INTERACT? OR PARTNER? OR CONVEX?(5N)CONCAV?
S20      1632   S (GUID? OR NAVIGAT? OR SLIDE? OR LOCK? OR SLIDING? OR
GLIDING?)(5N)(GROOV? OR CHANNEL? OR FURROW? OR TROUGH?)
S21        77   S (GUID? OR NAVIGAT? OR SLIDE? OR LOCK? OR SLIDING? OR
GLIDING?)(5N)(ANNULUS? OR ANNULI? OR KERF? OR DADO? OR TRENCH?)
S22      1180   S (GUID? OR NAVIGAT? OR SLIDE? OR LOCK? OR SLIDING? OR
GLIDING?)(5N)(GUTTER? OR CRATER? OR CHAMFER? OR SLOT?)
S23      2315   S UNDERCUT? OR UNDER()(CUT OR CUTS OR CUTTING) OR CUTIN? ? OR (CUT OR CUTS
OR CUTTING)()IN
S24     23385   S ANGLE? OR ANGULAR? OR INCLIN? OR TAPER? OR POINT? OR ATTENUAT? OR
CONVERG?
S25      9571   S SLANT? OR VECTOR? OR DECLIVIT? OR INTERSECT? OR (NON OR "NOT"
)()PARALLEL?
S26      5182   S UNPARALLEL? OR NONPARALLEL? OR ASYMPTOT? OR MEET??? OR (COME? OR CAME?
OR COMING)()TOGETHER
S27      9846   S ARROW? OR SAGITT? OR NARROW? OR ACUMINAT?
S28       125   S AU=(KELLER A? OR KELLER, A?)
S29       125   S KELLER(2N)(ARNIE OR ARNOLD)
S30      8259   S IC=A61F?
S31       126   S S28:S29
S32        43   S S31 AND S10 AND S1:S5(5N)S6:S9 AND S16:S27
S33        39   S S32 AND S30
S34        43   S S32:S33
S35     20931   S S10 AND S1:S5(7N)S6:S9 AND S16:S27
S36     13020   S S35 AND S6:S9(7N)S11:S15
S37      3507   S S36 AND S6:S9(7N)S16:S23
S38      1683   S S37 AND S30
S39      3507   S S37:S38
S40      1998   S S39 AND S6:S9(7N)S24:S27
S41      1462   S S40 AND S1:S5(3N)S6:S9 AND S11:S15(3N)S6:S9 AND S6:S9(5N)S16:S23
S42      1301   S S41 AND S6:S9(5N)S24:S27
S43       720   S S42 AND S30
S44      1462   S S41:S43
S45       399   S S44 AND S1:S5/TI AND S6:S9/TI
S46       291   S S43 AND S45
S47       285   S S44 AND S20:S23(7N)S6:S9
S48       582   S S45:S47
S49       392   S S48 AND S11:S15(10N)S16:S23
S50       392   S S49 NOT S34
S51       313   S S50 AND AC=US/PR
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S52        243   S S51 AND AY=(1970:2003)/PR
S53        227   S S51 NOT AY=(2004:2007)/PR
S54        243   S S52:S53
S55         79   S S50 NOT S51
S56         64   S S55 AND AY=1970:2003
S57         61   S S55 NOT AY=2004:2007
S58        307   S S54 OR S56:S57
S59        307   IDPAT (sorted in duplicate/non-duplicate order)
S60        304   IDPAT (primary/non-duplicate records only)

?  show files
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[File 348] **EUROPEAN PATENTS** 1978-2007/ 200708
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**File 348: For important information about IPCR/8 and forthcoming changes to the IC= index, see HELP NEWSIPCR.*

[File 349] **PCT FULLTEXT** 1979-2007/UB=20070308UT=20070301
(c) 2007 WIPO/Thomson. All rights reserved.
**File 349: For important information about IPCR/8 and forthcoming changes to the IC= index, see HELP NEWSIPCR.*

60/3K/83 (Item 83 from file: 348) **Links**
EUROPEAN PATENTS

00662672
Tibial component of a knee joint prosthesis
Tibiateil einer Kniegelenkprothese
Element tibial d'une prothese de genou
Tibial component of a knee joint prosthesis
Tibiateil einer Kniegelenkprothese
Element tibial d'une prothese de genou

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| | Country | Number | Kind | Date | |
|---|---|---|---|---|---|
| Patent | EP | 636352 | A2 | 19950201 | (Basic) |
| | EP | 636352 | A3 | 19950405 | |
| | EP | 636352 | B1 | 20020123 | |
| Application | EP | 94201907 | | 19940701 | |
| Priorities | US | 85714 | | 19930701 | |

Designated States:
CH; DE; ES; FR; GB; IT; LI; SE;

Related Divisions: Patent (Application):EP 925767 (EP 99200964)

International Patent Class (V7): A61F-002/38; A61F-002/38Abstract ...A2

Abstract Word Count: 52
NOTE: 1
NOTE: Figure number on first page: 1

| Type | Pub. Date | Kind | Text |
|---|---|---|---|

Publication: English
Procedural: English
Application: English

| Available Text | Language | Update | Word Count |
|---|---|---|---|
| CLAIMS A | (English) | EPABF2 | 537 |
| SPEC A | (English) | EPABF2 | 1738 |
| CLAIMS B | (English) | 200204 | 254 |
| CLAIMS B | (German) | 200204 | 300 |
| CLAIMS B | (French) | 200204 | 304 |
| SPEC B | (English) | 200204 | 1266 |
| Total Word Count (Document A) 2275 | | | |
| Total Word Count (Document B) 2124 | | | |
| Total Word Count (All Documents) 4399 | | | |

Specification: ...A2

BACKGROUND OF THE INVENTION

This invention relates to a prosthetic device for replacing the proximal tibial surface of a knee joint. More particularly it relates to a means for attaching the components of a modular tibial prostheses to one another.

Modular tibial prostheses having a base plate and a separate articular surface component require a reliable means for... ...knee designs which can transmit significant tilting loads to the articular surface component through a spine.

SUMMARY OF THE INVENTION

The present invention addresses these requirements by providing in a modular tibial prosthesis including a base plate and an articular component an interlocking two -segment dovetail mechanism. The plate has an upwardly extending rail around its periphery which merges with an upwardly extending two-segment dovetail. This continuous rail strengthens the base plate by eliminating notches along the plate periphery. This configuration is accommodated by the two-segment configuration which allows a continuous rail while maintaining dovetail engagement posteriorly. The two-segment dovetail also minimizes the dimensions of the anterior dovetail segment to reduce the requisite dovetail groove in the articular component thereby yielding a stronger articular component. The dovetail segments incorporate compound angles which engage a two-segment, compound angle, dovetail groove in the underside of the articular component to wedge the articular component against the proximal surface and anterior rail of the tibial plate. This wedging action resists sliding and separation between the tibial components.

In a preferred embodiment, the dovetail mechanism cooperates with a posterior tongue and groove arrangement to further resist separation of the tibial components.

The two -segment dovetail also allows the alternative use of an articular component having a reinforced spine on the... ...portion contains a slot which avoids engagement between the rigid base portion and the anterior dovetail segment on the plate. However, the posterior dovetail segments of the articular surface and the plate still engage one another. The base portion... ...periphery of the top surface 2. Also extending upwardly from the plate 1 top surface 2 is a two-segment dovetail comprising first 4 and second 5 segments. The rail 3 merges with the second segment 5 to eliminate notches in... ...of the plate 1 that could weaken the plate 1. The first segment 4 includes converging sides defining a lead-in angle. The lead-in angle can vary from 1 to 179 degrees but is preferably about 32 degrees. The second segment 5 also includes converging sides defining a lead-in angle. However, the second segment 5 sides are offset outwardly with respect to the first segment... ...and are therefore not co-linear with the first segment 4 sides. The first and second dovetail segments blend at a shoulder 6 to form a continuous, two-segment dovetail. Preferably the lead-in angle of the second segment 5 is the same as the lead-in angle of the first segment 4. The two-segment dovetail allows the continuous rail while maintaining dovetail engagement posteriorly, due to the offset of the second segment 5. It simultaneously minimizes the dimensions of the first, anterior, dovetail segment 4 to reduce the requisite dovetail groove in the articular component. This results in a stronger articular component with improved resistance to material cold flow. The two-segment dovetail has a dovetail angle 7 which can vary from 1 to 89 degrees but preferably is about 45 degrees. In the preferred embodiment the dovetail angle 7 is the same for both the first 4 and second 5 segments. The preferred embodiment also contains a posterior groove 8, formed as an undercut in a widened portion 9 of the posterior part of the rail 3. The base... ...rail 3 to resist outward migration of the component when it is compressively loaded. A two-segment dovetail slot 14 corresponding to the two-segment dovetail is formed in the lower surface 12. The preferred embodiment includes a posterior tongue 15... ...aid in articulation with a femoral component and which is elastically deformable to allow the dovetail interface described below.

In use the articular surface component 10 is positioned with its lower surface 12 in contact with the top of the rail 3 and with the dovetail segments 4 and 5 in alignment with the two -segment dovetail slot 14 as shown in FIG. 6. With a downward and rearward force, the articular component 10 is urged into engagement with the plate 1. The two-segment dovetail slot engages the first segment 4 first and then the second segment 5 and the tongue 15 engages the groove 8. As the dovetail engages the dovetail slot, the slot elastically deforms creating reactive forces tending to move the articular component forward... ...the top 2 of the plate 1. These forces occur due to the lead-in angle and dovetail angle 7 respectively. These reactive forces are advantageously distributed over both dovetail segments 4 and 5. As the front edge 19 of the articular component 10 clears... ...30 of the rigid base portion 26 fits over the first segment 4 of the dovetail and does not engage it. The second segment 5 does engage the dovetail slot 14 and the tongue 15 engages the groove 8 When the spined component 20... ...to the plate 1. The reinforcing component 22 in conjunction with the engagement of the second dovetail segment 5 with the dovetail slot 14 and the engagement of the tongue 15 and groove 8 provides secure fixation of the spined component 20 to the plate 1. This is...

Specification: ...B1

BACKGROUND OF THE INVENTION

This invention relates to a prosthetic device for replacing the proximal tibial surface of a knee joint. More particularly it relates to a means for attaching the components of a modular tibial prostheses to one another.

Modular tibial prostheses having a base plate and a separate articular surface component require a reliable means for... ...613 discloses a tibial base plate and separate articular surface component attached by means of dovetail slots

in the base extending around the periphery of the base.

SUMMARY OF THE INVENTION

The present invention addresses these requirements by providing in a modular tibial prosthesis including a base plate and an articular component an interlocking two-segment dovetail mechanism. The plate has an upwardly extending rail around its periphery which merges with an upwardly extending two -segment dovetail. This continuous rail strengthens the base plate by eliminating notches along the plate periphery. This configuration is accommodated by the two-segment configuration which allows a continuous rail while maintaining dovetail engagement posteriorly. The two-segment dovetail also minimizes the dimensions of the anterior dovetail segment to reduce the requisite dovetail groove in the articular component thereby yielding a stronger articular component. The dovetail segments incorporate compound angles which engage a two-segment, compound angle, dovetail groove in the underside of the articular component to wedge the articular component against the proximal surface and anterior rail of the tibial plate. This wedging action resists sliding and separation between the tibial components.

In a preferred embodiment, the dovetail mechanism cooperates with a posterior tongue and groove arrangement to further resist separation of the tibial components.

The two -segment dovetail also allows the alternative use of an articular component having a reinforced spine on the... ...portion contains a slot which avoids engagement between the rigid base portion and the anterior dovetail segment on the plate. However, the posterior dovetail segments of the articular surface and the plate still engage one another. The base portion... ...periphery of the top surface 2. Also extending upwardly from the plate 1 top surface 2 is a two-segment dovetail comprising first and second 5 segments. The rail 3 merges with the second segment 5 to eliminate notches in... ...of the plate 1 that could weaken the plate 1. The first segment 4 includes converging sides defining a lead-in angle. The lead-in angle can vary from 1 to 179 degrees but is preferably about 32 degrees. The second segment 5 also includes converging sides defining a lead-in angle. However, the second segment 5 sides are offset outwardly with respect to the first segment... ...and are therefore not co-linear with the first segment 4 sides. The first and second dovetail segments blend at a shoulder 6 to form a continuous, two-segment dovetail. Preferably the lead-in angle of the second segment 5 is the same as the lead-in angle of the first segment 4. The two-segment dovetail allows the continuous rail while maintaining dovetail engagement posteriorly, due to the offset of the second segment 5. It simultaneously minimizes the dimensions of the first, anterior, dovetail segment 4 to reduce the requisite dovetail groove in the articular component. This results in a stronger articular component with improved resistance to material cold flow. The two-segment dovetail has a dovetail angle 7 which can vary from 1 to 89 degrees but preferably is about 45 degrees. In the preferred embodiment the dovetail angle 7 is the same for both the first 4 and second 5 segments. The preferred embodiment also contains a posterior groove 8, formed as an undercut in a widened portion 9 of the posterior part of the rail 3. The base...rail 3 to resist outward migration of the component when it is compressively loaded. A two-segment dovetail slot 14 corresponding to the two-segment dovetail is formed in the lower surface 12. The preferred embodiment includes a posterior tongue 15... ...aid in articulation with a femoral component and which is elastically deformable to allow the

dovetail interface described below.

In use the articular surface component 10 is positioned with its lower surface 12 in contact with the top of the rail 3 and with the dovetail segments 4 and 5 in alignment with the two -segment dovetail slot 14 as shown in FIG. 6. With a downward and rearward force, the articular component 10 is urged into engagement with the plate 1. The

two-segment dovetail slot engages the first segment 4 first and then the second segment 5 and the tongue 15 engages the groove 8. As the dovetail engages the dovetail slot, the slot elastically deforms creating reactive forces tending to move the articular component forward... ...the top 2 of the plate 1. These forces occur due to the lead-in angle and dovetail angle 7 respectively. These reactive forces are advantageously distributed over both dovetail segments 4 and 5. As the front edge 19 of the articular component 10 clears...

Claims: ...A2

1. An implant for the human knee comprising a tibial base plate having:

a generally planar top surface;

a first dovetail segment extending upwardly from the top surface and having converging sides; and

a second dovetail segment extending upwardly from the top surface and having converging sides, the converging sides of the second segment being offset outwardly with respect to the converging sides of the first segment such that the converging sides of the first segment are not collinear with the converging sides of the second segment.

2. The implant of claim 1 further comprising a rail extending above the top surface and extending substantially all the way around the top surface.

3. The implant of claim 2 wherein a portion of the rail is undercut to form a tongue receiving groove.

4. The implant of claim 3 further comprising a tibial articular surface having:

an upper surface for articulation with a femoral implant;

a lower surface for engagement with the tibial base plate, the lower surface having an outer edge shaped to fit within the rail, the lower surface further containing a dovetail groove shaped to receive the first and second dovetail segments; and

a tongue formed in a portion of the outer edge, the tongue shaped to fit within the tongue receiving groove.

5. The implant of claim 4 further comprising:

a spine extending upwardly from the upper surface, the spine containing a post hole, the post hole opening onto the lower surface;

a reinforcing component... ...hole, and a clearance slot formed in the bottom adapted to fit over the first dovetail segment without engaging the dovetail angle.

6. A prosthetic implant for the knee comprising:

a tibial base plate having a generally planar top surface;

a tibial articular surface component having an upper surface and a lower surface; a spine extending upwardly... ...the reinforcing component tightly against the base plate when the screw is tightened.

8. The implant of claim 6 further comprising a dovetail extending upwardly from the top surface of the base plate and wherein the base portion... ...the reinforcing component contains a clearance slot adapted to fit over a portion of the dovetail without engaging the dovetail when the post is placed in the post hole and the articular surface component is...

Claims: ...B1

1. An implant for the human knee comprising a tibial base plate (1) having dovetail segments characterised in that the plate (1) further comprises

a generally planar top surface (2);

a first dovetail segment (4) extending upwardly from the top surface (2), the segment (4) having converging sides, the converging sides forming a lead-in angle; and

a second dovetail segment (5) extending upwardly from the top surface, the second dovetail segment (5) having converging sides, the sides forming a lead-in angle, the converging sides of the second segment (5) being offset outwardly with respect to the converging sides of the first segment (4) such that the converging sides of the first segment (4) are not collinear with the converging sides of the second segment (5).

2 . The implant of claim 1 further comprising a rail (3) extending above the top surface (2) and extending substantially all the way around the top surface (2).

3. The implant of claim 2 wherein a portion of the rail (3) is undercut to form a tongue receiving groove (8).

4. The implant of claim 3 further comprising a tibial articular surface (10) having:

an upper surface (11) for articulation with a femoral implant;

a lower surface (12) for engagement with the tibial base plate (1), the lower surface (12) having an outer edge (13) shaped to fit within the rail (3), the lower

surface (12) further containing a dovetail groove (14) shaped to receive the first and second dovetail segments (4, 5); and

a tongue (15) formed in a portion of the outer edge, the tongue (15) shaped to fit within the tongue receiving groove (8).

Claims: ...B1

60/3K/19 (Item 19 from file: 348) **Links**
EUROPEAN PATENTS

01740691

# Apparatus for achieving correct limb alignment in unicondylar knee arthroplasty

Vorrichtung zum Ausrichten des Beines fur eine unikondylare Arthroplastie des Knies

Appareil pour realiser la correction de l'alignement d'une jambe lors d'une arthroplastie unicondylienne du genou


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| | Country | Number | Kind | Date | |
|---|---|---|---|---|---|
| Patent | EP | 1424042 | A2 | 20040602 | (Basic) |
| | EP | 1424042 | A3 | 20040825 | |
| | EP | 1424042 | A3 | 20040825 | |
| Application | EP | 2003257497 | | 20031127 | |
| Priorities | US | 305697 | | 20021127 | |

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CH; DE; ES; FR; GB; IT; LI;

Extended Designated States:
AL; LT; LV; MK;

International Patent Class (V7): A61B-017/15Abstract Word Count: 200

NOTE: 20
NOTE: Figure number on first page: 20

| Type | Pub. Date | Kind | Text |
|---|---|---|---|

Publication: English
Procedural: English
Application: English

| Available Text | Language | Update | Word Count |
|---|---|---|---|
| CLAIMS A | (English) | 200423 | 891 |
| SPEC A | (English) | 200423 | 7133 |
| Total Word Count (Document A) 8024 | | | |
| Total Word Count (Document B) 0 | | | |
| Total Word Count (All Documents) 8024 | | | |

Specification: ...for achieving correct limb alignment and linking the distal femoral cut to the proximal tibial cut in unicondylar knee arthroplasty, including minimally invasive unicondylar knee arthroplasty. 2. Description of the Related Art.

Orthopedic procedures for the replacement of all, or a portion of, a patient's joint have been developed over the last thirty years. Currently, the procedures used to prepare the bone and seat the implants are generally referred to as open procedures. For the purposes of this discussion, the term... ...the appropriate compartment of the knee, including portions of the distal femur and the proximal tibia. The distal femur and proximal tibia of the affected compartment are also shaped to receive a unicondylar knee prosthesis.

In traditional unicondylar knee arthroplasty, leg alignment requires a trial and error technique in which the surgeon makes one... ...thereafter selects the location of the other of the distal femoral cut and the proximal tibial cut based on experience and the knowledge that tibial prostheses are available in a limited number of thicknesses. Typically, the proximal tibial cut is made so as to remove the least amount of the proximal tibia, while ensuring sufficient removal of diseased or otherwise undesirable bone. The remaining femoral cuts are made to complete shaping of the femur to receive a femoral prosthesis. After the femoral and tibial cuts are complete, the femoral prosthesis and the tibial prosthesis, or provisional versions thereof, are temporarily implanted and leg alignment is reviewed by the surgeon. If the tibial prosthesis does not include an integral bearing component, then a discrete bearing component is also implanted. To adjust leg alignment, the surgeon can replace the tibial prosthesis, or bearing component with an alternative tibial prosthesis, or bearing component having an increased or decreased thickness. The surgeon may also recut the femur and/or use a different femoral implant to achieve appropriate leg alignment. The surgeon can also remove more tibial bone stock and again use the previously used tibial prosthesis, or replace the previously used tibial prosthesis with a tibial prosthesis of a different thickness. This procedure of trial and error is conducted until the surgeon... ...art technique utilizes a spacing mechanism to extend the spacing in the compartment of the knee receiving the unicondylar knee prosthesis. In this prior art technique, the compartment spacing is extended until the surgeon is happy... ...The present invention provides a minimally invasive procedure for creating correct limb alignment in unicondylar knee arthroplasty. Depending on which compartment of the knee is receiving a prosthesis, either a medial, or a lateral parapatellar incision is made to expose the knee joint. The incision used in the method of the present invention is smaller than the... ...accommodate insertion of the headless securing devices therein. Each of the hole pairs of the tibial cut block correspond to a different implant thickness. The tibial cut block also includes a tibial cut slot through which the proximal tibial cut can be made. The tibial cut is attached to the tibia by positioning the headless securing devices

into the appropriate hole pair for the desired implant, and, after making the sagittal cut in the proximal tibia, the horizontal tibial cut is made through the tibial cut slot.

An advantage of the present invention is the ability to perform a unicondylar... ...a perspective view of the adjustable alignment block of Figures 6-12, with a minus 2 millimeter femoral spacer secured thereto;

Figures 15-17 are side, top, and end views, respectively of an alignment... ...27-27' of Figure 26;

Figure 28 is a side plan view of a minus 2 millimeter femoral spacer of the present invention;

Figure 29 is a top plan view thereof;

Figure 30 is... ...Figure 38 is a perspective view illustrating use of a reciprocating saw to make the sagittal cut in the relevant knee compartment; and

Figure 39 is a perspective view illustrating use of an... ...the knee and draw a second line down the center of the tibial shaft. The angle formed by these two lines represents the angle of deformity (for all) as illustrated in Figure 2.

Figure 2 schematically illustrates knee joint... ...femoral head 16' to the center of distal femur 18' at knee 24 forms an angle V with line 22' drawn down the center of the shaft of tibia 12'. This angle V represents the angle of varus deformity of knee joint 24. Figure I illustrates healthy knee joint 14. As... ...center of the shaft of tibia 12, representing a knee joint without deformity. If the angle of deformity V is 15 degrees or greater, the patient is likely not a candidate... ...accessible to allow for assessing the femoral head location which is used to determine the angle of deformity V as illustrated in Figure 2 and discussed above. At this point, anatomic landmarks may be utilized to identify the location of the femoral head. In one... ...can be positioned over the center of the femoral head to serve as a reference point. In one exemplary embodiment, the location of the femoral head is confirmed with an anterior... ...the joint capsule distal to the vastus medialis in line with incision 28 to a point that exposes the anterior margin of the femoral condyle as illustrated in Figure 4. The... ...slot 62. Spacer bevels 64 and spacer slot 62 are utilized in conjunction with minus 2 millimeter femoral spacer 56 as further described hereinbelow. Opposite femoral paddle 42, alignment tower boss 54 extends from... ...further includes tibial paddle groove 50 in which tibial paddle 44 is positioned. Tibial paddle groove 50 guides movement of tibial paddle 44 between the closed position of adjustable alignment block 38 illustrated... ...fully described hereinbelow.

If there is significant erosion of the femoral condyle, two millimeters less bone may be resected from the distal femoral condyle. In such a case, minus two millimeter distal femoral spacer 56 (Figures 28-31) will be positioned atop femoral paddle 42 of adjustable alignment block 38 as illustrated in Figure 14. With minus two millimeter distal femoral spacer 56 attached to femoral paddle 42 of adjustable alignment block 38, femoral cut slot 40 will be moved two millimeters distally with respect to distal femur 18' from the position illustrated in Figure 13, i.e., a position in which minus two millimeter distal femoral spacer 56 is not secured to femoral paddle 42 of adjustable alignment block 38. Therefore, two millimeters less femoral bone will be resected when an oscillating saw is positioned through femoral cut slot 40 when minus two millimeter distal femoral spacer is utilized.

Minus 2 millimeter femoral spacer 56 is illustrated in detail in Figures 28-31. As illustrated in Figure 28, minus 2 millimeter femoral spacer 56 has height H measuring 2 millimeters. With this in mind, with minus 2 millimeter femoral spacer 56 positioned atop femoral paddle 42 as illustrated in Figure 14, cut slot 40 will... ...along femur 18' relative to its position when adjustable alignment block 38 is positioned in knee joint 24 without minus 2

millimeter femoral spacer 56.

Femoral spacers of varying heights may be utilized in accordance with the present invention to adjust the depth of the distal femoral resection. Minus 2 millimeter femoral spacer 56 is illustrated in detail in Figures 28-31. As illustrated in Figure 31, femoral spacer 56 includes dovetails 84 extending from a lower surface thereof to effect securement of distal femoral spacer 56... ...As illustrated in Figure 11, femoral paddle 42 of adjustable alignment block 38 includes opposing spacer bevels 64 which facilitate expansion of dovetails 84 of minus 2 millimeter femoral spacer 56 to allow for positioning of minus 2 millimeter femoral spacer 56 atop femoral paddle 42. Furthermore, referring to Figures 29 and 30, minus 2 millimeter femoral spacer 56 includes a pair of expansion slots 58 facilitating outward expansion of dovetails 84 when securing minus 2 millimeter femoral spacer 56 to femoral paddle 42 of adjustable alignment block 38. When minus 2 millimeter femoral spacer 56 is secured to femoral paddle 42, adjustable alignment block protrusion 66 thereof fits within spacer slot 62 of femoral paddle 42 to prevent sliding of minus 2 millimeter femoral spacer 56 with respect to femoral paddle 42. To remove minus 2 millimeter femoral spacer 56 from femoral paddle 42, a pry bar is inserted therebetween to urge adjustable alignment block protrusion 66 out of spacer slot 62 of femoral paddle 42. Minus 2 millimeter femoral spacer 56 can then be slid from engagement with femoral paddle 42.

With adjustable alignment block 38 positioned with femoral paddle 42 (with or without minus two millimeter distal femoral spacer 56 secured thereto) positioned in the space created in the affected compartment as illustrated in...is connected to distal telescoping rod 90. Referring to Figure 27, ankle clamp 120 includes dovetail channel 122 sized to accommodate dovetail 94 (Figure 22) of distal telescoping rod 90. As illustrated in Figure 22, distal telescoping... ...rod 102 which is threadedly engaged in ankle clamp retaining cylinder 104 and extends through dovetail 94. With dovetail 94 positioned in dovetail channel 122, ankle clamp retaining knob 98 is rotated to force an end of ankle clamp retaining rod 102 to extend from the bottom surface of dovetail 94 and create an interference fit between dovetail 94 and dovetail channel 122. Ankle clamp 120 may, in one exemplary embodiment, include a channel for accommodating the end of ankle clamp retaining rod 102 extending below dovetail 94.

With ankle clamp 120 temporarily secured to distal telescoping rod 90, spring arms 124... ...alignment tower 70 secured to adjustable alignment block 38, ankle clamp 120 is slid onto

dovetail 94 of distal telescoping rod 90 with ankle clamp retaining knob 98 tightened to temporarily... ...effected compartment of the knee, with the ankle clamp positioned above the ankle. At this point, spring arms 124 are moved against the biasing force of springs 126 into an open... ...medial and lateral malleoli. For the medial compartment arthroplasty disclosed herein, distal tip 106 should point to the second metatarsal. When distal tip 106 of distal telescoping rod 90 is properly... ...is now positioned in the desired alignment by moving the leg until targeting guide 110 points toward the center of the femoral head. Over correction should be avoided. It is preferable... ...10' to avoid over torquing and the consequent stripping of the bone stock. At this point alignment is verified, and, if unchanged, alignment tower 70, round alignment rod 100, square alignment... ...in Figure 34, the longitudinal axes of holes 142 and 146 form a three degree angle with resection slot 150, allowing for a three degree tibial slope. It is contemplated that... ...marked 10, 12, and 14. These hole pair designations correspond to the size of the tibial prosthetic implant, i.e., the tibial component and the bearing surface. While the exemplary embodiment includes hole pairs marked 8, 10, 12, and 14, it is contemplated that a tibial cut block in accordance with the present invention could include additional cut depths corresponding to tibial prostheses of alternative thicknesses. Initially, the headless screws protruding from tibia 12' are inserted through hole pair 142/142' corresponding to an 8 millimeter tibial articular... ...the middle being measured anterior to posterior, i.e., along a line contained in a sagittal plane.

After tibial cut block 140 is positioned over the headless tibial screws, the knee... ...cut block 140, then the incision may be lengthened. In one exemplary embodiment, a resection guide can be inserted through resection slot 150 to help verify that the chosen tibial resection will be adequate. If the resection... ...next hole pair as necessary.

Once tibial cut block 140 is properly positioned, with headless tibial screws 160 extending through a hole pair thereof, the tibia is resected to receive a tibial implant. When resecting the femur, a retractor can be inserted medially to protect the medial collateral ligament. As illustrated in Figure 38, the sagittal cut in tibial 12' can be made free hand. With the knee flexed, blade 152 of reciprocating... ...surface 158 is utilized as a guide to determine the anterior/posterior slope of the sagittal cut. Cutting to proximal surface 158 of tibial cut block 140 leaves approximately 3-4 millimeters of unresected bone of the sagittal cut. Tibial cut block 140 can be manually held in place against the bone during... ...above the hole pair that will be used for the horizontal cut when making the sagittal cut. For example, if the hole pair corresponding to an 8 millimeter cut, i.e... ...140 even with the desired proximal resection level and provide a mechanical stop for the sagittal cut. Note that in the exemplary embodiment disclosed, this option is only available when an 8 millimeter or 10 millimeter implant cut depth is the desired horizontal resection level.

Figure 39 illustrates hemostat 162 clamped to lateral tibial headless pin 160 to secure tibial cut block 140 flush against tibia 12'. As illustrated... ...tibial cut block 140 to make the proximal tibial cut. When making the proximal tibial cut in this fashion, care should be taken to avoid undercutting tibial eminence 156. After the horizontal proximal tibial resection is complete, tibial cut block 140 and headless tibial screws 160 are removed. And, if the sagittal cut is unfinished, this cut is completed and the resected tibial bone fragment is removed... ...cut slot 40 of adjustable alignment box 38 can be utilized to complete shaping of femur 10'. Provisional femoral and tibial implants are now used to perform a trial reduction and final implants are subsequently seated.

In an alternative embodiment of the present invention, the tibial cuts can be first made by aligning the joint with the alignment apparatus described above...

Claims: ...paddle is moved to abut a proximal tibia, with said femoral paddle abutting a distal femur when said knee is positioned to correct limb alignment.

7. The apparatus of claim 6, further comprising:

a femoral spacer secured to said femoral paddle of said spacing means, said femoral spacer having a thickness extending toward the distal femur.

8. An apparatus for preparing a knee for receiving a knee prosthesis, comprising:

a femoral cut block having a femoral cut slot;

a tibial cut block having a tibial cut slot; and

means for linking said femoral cut slot and said tibial cut slot... ...moveable connected to said body, whereby said tibial paddle is moved to abut a proximal tibia, with said femoral paddle abutting a distal femur when said knee is positioned to correct limb alignment; and

a femoral spacer releasably secured to said femoral paddle, said femoral spacer having a thickness extending toward the distal femur when said femoral spacer is secured to said femoral paddle and said apparatus is operably

positioned to maintain the spacing in a knee compartment to correct limb alignment.

13. The apparatus of claim 12, wherein said femoral spacer includes a pair of opposing dovetails extending from a lower surface thereof to releasably secure said femoral spacer to said femoral paddle, said femoral spacer further includes an expansion channel extending the thickness of the femoral spacer and positioned intermediate said dovetails.

14. An alignment apparatus for correcting alignment of a leg, comprising:

a spacer for insertion into a compartment of a knee;

a tibial alignment rod connected to said spacer, said tibial alignment rod having a longitudinal axis;

an ankle clamp releasably connected to said tibial alignment rod; and

a femoral alignment rod connected to said spacer, said femoral alignment rod having a longitudinal axis, said longitudinal axis of said tibial alignment rod and said longitudinal axis of femoral alignment rod being one of collinear and... ...femoral alignment rod.

16. An alignment apparatus for correcting alignment of a leg, comprising:

a spacer for insertion into a compartment of a knee;

a tibial alignment rod connected to said spacer, said tibial alignment rod having a longitudinal axis;

a femoral alignment rod connected to said spacer, said femoral alignment rod having a longitudinal axis, said longitudinal axis of said tibial alignment rod and said longitudinal axis of femoral alignment rod being one of collinear and ...

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(12) **United States Patent**
**Hodorek et al.**

(10) **Patent No.: US 7,094,241 B2**
(45) **Date of Patent: Aug. 22, 2006**

(54) **METHOD AND APPARATUS FOR ACHIEVING CORRECT LIMB ALIGNMENT IN UNICONDYLAR KNEE ARTHROPLASTY**

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(73) Assignee: **Zimmer Technology, Inc.**, Chicago, IL (US)

( * ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 358 days.

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(51) **Int. Cl.**
*A61F 5/00* (2006.01)

(52) **U.S. Cl.** ..... **606/87**

(58) **Field of Classification Search** ..... 606/53, 606/54, 60, 86, 102; 128/898
See application file for complete search history.

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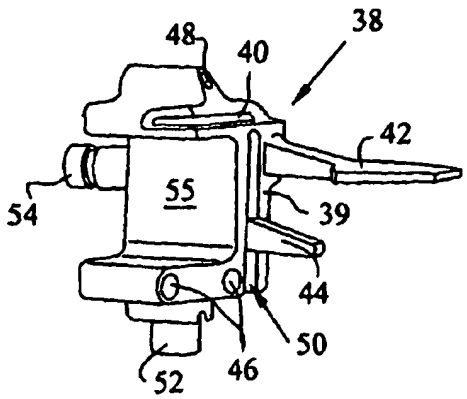
(57) **ABSTRACT**

A method and apparatus for correcting limb alignment in a unicondylar knee arthroplasty and linking the distal femoral cut and the proximal tibial cut. Alignment rods are connected to a spacing apparatus to facilitate correction of limb alignment. The alignment rods are positioned along the mechanical axis of the femur and the tibia and the knee joint is positioned to correct alignment. A spacing apparatus is positioned in the relevant knee compartment and utilized to hold the knee in position to correct limb alignment. The spacing apparatus includes a femoral cut slot through which the distal femoral cut is made and further includes tibial affixment apertures through which a headless securing device can be positioned to secure the spacing apparatus to the tibia. After the distal femoral resection is complete, the spacing apparatus is removed, with the headless securing devices remaining positioned in the tibia. The headless securing devices are used as a reference for securing a tibial cut block to the tibia for making the proximal tibial resection. With the mechanism of the present invention, the knee can be placed in flexion when making the proximal tibial cut and the distal femoral cut is linked to the proximal tibial cut.

**16 Claims, 12 Drawing Sheets**



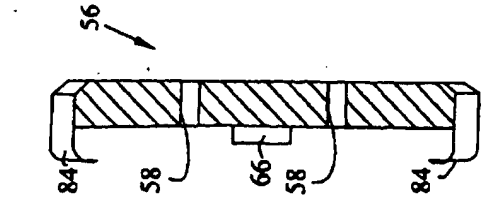



FIG. 31

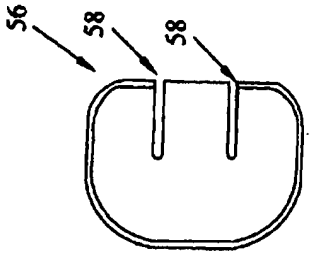



FIG. 29

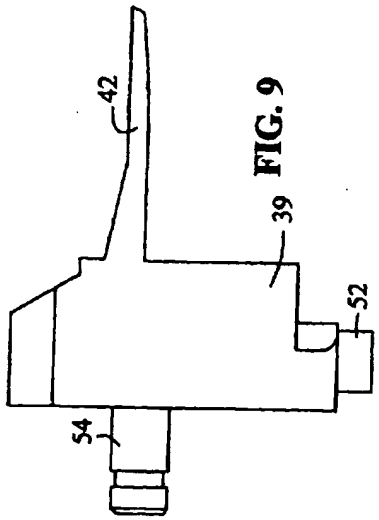



FIG. 9

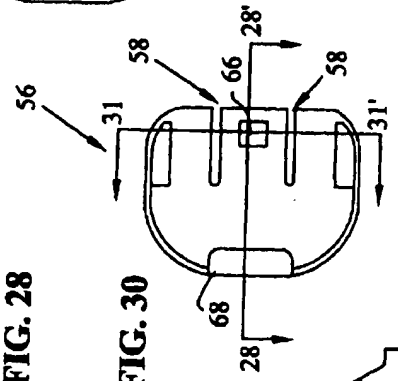



FIG. 30

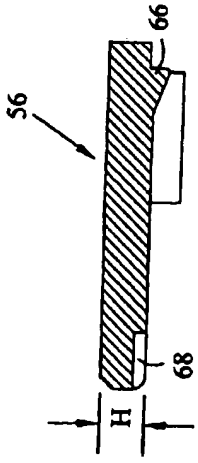



FIG. 28

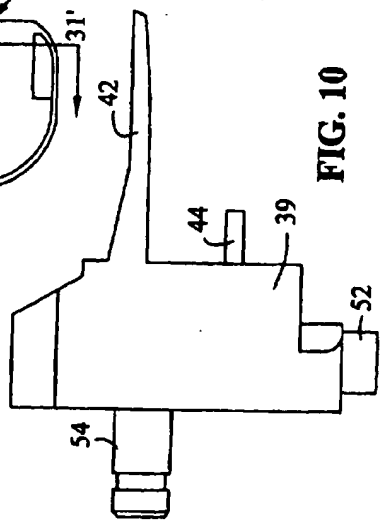



FIG. 10

Adjustable alignment block **38** illustrated herein is a left medial/right lateral adjustable alignment block. An alternative alignment block can be utilized for a right medial unicondylar knee arthroplasty and a left lateral unicondylar knee arthroplasty. Such an alternative alignment block will be a mirror image of alignment block **38** illustrated herein. Referring to FIG. **12**, the mirror image alignment block would include tibial affixment apertures **46** positioned to the left of tibial paddle actuation knob **52**. Furthermore, in the alternative embodiment adjustable alignment block, femoral cut slot **40** would extend further to the left of tibial paddle actuation knob **52** from the perspective of FIG. **12**.

If the joint is too tight to allow insertion of femoral paddle **42** of adjustable alignment block **38** into knee **24** as described above, additional anterior tibial bossing should be removed, as described with reference to FIG. **5**, to create more space for inserting alignment block **38**. Patellar osteofites can be removed for better exposure. Advantageously, the technique of the present invention does not require movement of the patella. Adjustable alignment block **38** will be used to hold the joint in proper alignment and will further be used as a resection guide when making the distal femoral cut as is fully described hereinbelow.

If there is significant erosion of the femoral condyle, two millimeters less bone may be resected from the distal femoral condyle. In such a case, minus two millimeter distal femoral spacer **56** (FIGS. **28–31**) will be positioned atop femoral paddle **42** of adjustable alignment block **38** as illustrated in FIG. **14**. With minus two millimeter distal femoral spacer **56** attached to femoral paddle **42** of adjustable alignment block **38**, femoral cut slot **40** will be moved two millimeters distally with respect to distal femur **18'** from the position illustrated in FIG. **13**, i.e., a position in which minus two millimeter distal femoral spacer **56** is not secured to femoral paddle **42** of adjustable alignment block **38**. Therefore, two millimeters less femoral bone will be resected when an oscillating saw is positioned through femoral cut slot **40** when minus two millimeter distal femoral spacer is utilized.

Minus 2 millimeter femoral spacer **56** is illustrated in detail in FIGS. **28–31**. As illustrated in FIG. **28**, minus 2 millimeter femoral spacer **56** has height H measuring 2 millimeters. With this in mind, with minus 2 millimeter femoral spacer **56** positioned atop femoral paddle **42** as illustrated in FIG. **14**, cut slot **40** will be moved 2 millimeters distally along femur **18'** relative to its position when adjustable alignment block **38** is positioned in knee joint **24** without minus 2 millimeter femoral spacer **56**.

Femoral spacers of varying heights may be utilized in accordance with the present invention to adjust the depth of the distal femoral resection. Minus 2 millimeter femoral spacer **56** is illustrated in detail in FIGS. **28–31**. As illustrated in FIG. **31**, femoral spacer **56** includes dovetails **84** extending from a lower surface thereof to effect securement of distal femoral spacer **56** to femoral paddle **42** of adjustable alignment block **38**. As illustrated in FIG. **11**, femoral paddle **42** of adjustable alignment block **38** includes opposing spacer bevels **64** which facilitate expansion of dovetails **84** of minus 2 millimeter femoral spacer **56** to allow for positioning of minus 2 millimeter femoral spacer **56** atop femoral paddle **42**. Furthermore, referring to FIGS. **29** and **30**, minus 2 millimeter femoral spacer **56** includes a pair of expansion slots **58** facilitating outward expansion of dovetails **84** when securing minus 2 millimeter femoral spacer **56** to femoral paddle **42** of adjustable alignment block **38**. When minus 2 millimeter femoral spacer **56** is secured to femoral paddle **42**, adjustable alignment block protrusion **66** thereof fits within spacer slot **62** of femoral paddle **42** to prevent sliding of minus 2 millimeter femoral spacer **56** with respect to femoral paddle **42**. To remove minus 2 millimeter femoral spacer **56** from femoral paddle **42**, a pry bar is inserted therebetween to urge adjustable alignment block protrusion **66** out of spacer slot **62** of femoral paddle **42**. Minus 2 millimeter femoral spacer **56** can then be slid from engagement with femoral paddle **42**.

With adjustable alignment block **38** positioned with femoral paddle **42** (with or without minus two millimeter distal femoral spacer **56** secured thereto) positioned in the space created in the affected compartment as illustrated in FIG. **13**, alignment tower **70**, which is illustrated in detail in FIGS. **15–18**, is secured to adjustable alignment block **38** as illustrated in FIG. **19**. Referring to FIG. **18**, alignment tower **70** includes boss aperture **72** sized for placement of alignment tower boss **54** therein when alignment tower **70** is secured to adjustable alignment block **38**. Alignment tower **70** further includes alignment protrusion **74** which abuts base **55** of adjustable alignment block **38** when alignment tower **70** is secured to adjustable alignment block **38**. Alignment protrusion **74** is wedge shaped as illustrated in FIGS. **15** and **18**. As alignment tower boss **54** of adjustable alignment block **38** traverses boss aperture **72** of alignment tower **70**, alignment protrusion **74** contacts base **55** of adjustable alignment block **38** and, owing to its wedge shape, locks alignment tower **70** to adjustable alignment block **38**. With alignment tower boss **54** positioned within boss aperture **72**, and alignment protrusion **74** abutting base **55**, alignment tower **70** is secured to adjustable alignment block **38** and will not rotate relative thereto. With adjustable alignment block **38** positioned as illustrated in FIGS. **13** and **19**, and with alignment tower **70** secured thereto as illustrated in FIG. **19**, alignment rod receiving end **76** of alignment tower **70** is located between the condyles of distal femur **18'**.

The alignment device is now fully assembled as illustrated in FIG. **20**. With adjustable alignment block **38** and alignment tower **70** positioned as illustrated in FIG. **19**, first end **128** of square alignment rod **80** is inserted into square alignment rod aperture **78** (FIG. **15**) of alignment tower **70** as illustrated in FIGS. **19** and **20**. The opposite end of square alignment rod **80** is thereafter inserted into elongate square alignment rod aperture **92** (FIG. **24**) of distal telescoping rod **90** (FIGS. **21–14**) as illustrated in FIG. **20**.

Prior to inserting square alignment rod **80** into elongate square alignment rod aperture **92** (FIG. **24**) of distal telescoping rod **90**, ankle clamp **120** (FIGS. **25–27**) is connected to distal telescoping rod **90**. Referring to FIG. **27**, ankle clamp **120** includes dovetail channel **122** sized to accommodate dovetail **94** (FIG. **22**) of distal telescoping rod **90**. As illustrated in FIG. **22**, distal telescoping rod **90** includes ankle clamp retaining knob **98** to temporarily secure ankle clamp **120** to distal telescoping rod **90**. As illustrated in FIGS. **22–24**, ankle clamp retaining knob **98** is secured to ankle clamp retaining rod **102** which is threadedly engaged in ankle clamp retaining cylinder **104** and extends through dovetail **94**. With dovetail **94** positioned in dovetail channel **122**, ankle clamp retaining knob **98** is rotated to force an end of ankle clamp retaining rod **102** to extend from the bottom surface of dovetail **94** and create an interference fit between dovetail **94** and dovetail channel **122**. Ankle clamp **120** may, in one exemplary embodiment, include a channel for accommodating the end of ankle clamp retaining rod **102** extending below dovetail **94**.

With ankle clamp **120** temporarily secured to distal telescoping rod **90**, spring arms **124** are opened against the

60/3K/30 (Item 30 from file: 348) **Links**
EUROPEAN PATENTS

01607523

# Surgically implantable knee prosthesis having medially shifted tibial surface

Knieendoprothese mit medial versetzter Tibiaflache
Endoprothese du genou a surface tibiale deplacee medialement
Endoprothese du genou a surface tibiale deplacee medialement

Patent Assignee:

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  (Applicant designated States: all)

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| | Country | Number | Kind | Date | |
|---|---|---|---|---|---|
| Patent | EP | 1327424 | A1 | 20030716 | (Basic) |
| Application | EP | 2003000744 | | 20030113 | |
| Priorities | US | 44756 | | 20020111 | |
| | US | 44224 | | 20020111 | |
| | US | 44677 | | 20020111 | |
| | US | 44159 | | 20020111 | |

Designated States:
AT; CH; DE; FR; GB; IT; LI;

Extended Designated States:
AL; LT; LV; MK; RO;

International Patent Class (V7): A61F-002/38; A61F-002/38Abstract Word Count: 84
NOTE: 4B
NOTE: Figure number on first page: 4B

| Type | Pub. Date | Kind | Text |
|---|---|---|---|

Publication: English
Procedural: English
Application: English

| Available Text | Language | Update | Word Count |
|---|---|---|---|
| CLAIMS A | (English) | 200329 | 1827 |
| SPEC A | (English) | 200329 | 10501 |
| Total Word Count (Document A) 12328 | | | |
| Total Word Count (Document B) 0 | | | |
| Total Word Count (All Documents) 12328 | | | |

Specification: ...A1

The present invention pertains to prosthetic devices. More particularly, the invention pertains to knee joint prostheses which may be surgically implanted between the femoral condyle and tibial plateau of the knee joint.

Articular cartilage and meniscal cartilage provide the mobile weight bearing surfaces of the knee... ...to total knee arthroscopy (TKA). However, an HTO does leave a hard sclerotic region of bone which is difficult to penetrate making conversion to a total knee replacement (TKR) technically challenging. Unicompartmental and bicompartmental total knee replacements resect significant amounts of bone and, if performed on younger patients, will likely require revision surgery as they age. Revision total knee replacement surgery is usually extensive and results in predictably diminished mechanical life expectancy. Therefore, it is... ...materials and surgical technology required to accomplish this replacement task do not yet exist.

Currently, replacement of the existing ...with materials other than articular cartilage, is only possible with a total or uni-condylar knee replacement, and these procedures require removal of significant amounts of the underlying bone structure.

The alternative method is to fill the joint space with a spacer that replaces the missing articular materials. This spacer should also provide an anatomically correct bearing surface for both the tibial and femoral surface (U.S. Patent 6,206,927).

Attaching a new bearing surface to... ...plateau. Others include a series of polymeric materials such as PVA Hydrogels in a titanium mesh as described by Chang et al, "Historical Comparison of Tibial Articular Surfaces Against Rigid Materials And Artificial Articular Cartilage," Journal of Biomedical Material Research, 37, 51-59, 1997, biodegradable anhydride prepolymers that... ...within the joint while further being able to survive the mechanical loading conditions of the knee.

Therefore, what is needed is a uni-compartmental interpositional spacer which, by effectively replacing worn articular material, restores normal joint alignment without requiring any bone resection or any means of bone fixation and provides an anatomically correct bearing surface for the femoral condyle to articulate against.

According to one embodiment, an implantable knee prosthesis includes a body having a substantially elliptical shape in plan and a pair of opposed... ...the thickness of the peripheral edge at the second side, the first end and the second end.

According to another embodiment, the prosthesis includes a body having a substantially elliptical shape in plan

and a pair of opposed... ...a second shape different from the first shape; and the peripheral edge extending at an incline between the first face and the second face.

According to another embodiment, the prosthesis includes a body having a substantially elliptical shape in plan and including a first portion... ...from the first peripheral edge to form a shoulder between the first portion and the second portion.

According to another embodiment, the prosthesis comprises a two-piece body having a substantially elliptical shape in plan; a first piece being a tibial piece including a tibial surface; a second piece being a femoral piece including a femoral surface; the first piece and the second piece being mutually slidably engagable and separable.

The invention also relates to a method of providing a knee prosthesis comprising: providing a body having a substantially elliptical shape in plan and a pair of... ...second shape, different from the first shape; and providing a peripheral edge extending at an incline between the first face and the second face.

In another embodiment the method comprises the...surface; providing the second piece with a femoral surface; and the first piece and the second piece being mutually slidably engagable and separable.

Each of the above-mentioned embodiments is an independent aspect of the invention... ...following drawings, in which:

Fig. 1 is a plan view illustrating an embodiment of an implantable knee prosthesis.

Fig. 2 is a cross-sectional view taken along the line A-A of Fig.1.

Fig... ...several views of a further embodiment of the device.

Fig. 13 illustrates placement of the prosthesis in a knee joint.

The present device is an implantable knee prosthesis in the form of a uni-compartmental interpositional spacer which, by effectively replacing worn articular material, restores the normal joint alignment and provides a... ...collateral ligaments. By occupying the joint space and retensioning the collateral ligaments, the unicompartmental interpositional spacer improves joint stability and restores the limb to a more normal mechanical alignment.

An implantable knee prosthesis 100 is illustrated in Fig. 1. An anterior/posterior (A/P) cross-sectional view is... ...B and illustrated in Fig. 3. A Coordinate System Origin (CSO) 10 is at the intersection of lines A-A and B-B. Prosthesis 100, Figs. 1-3, includes a body 102 having a peripheral edge 112, a first or tibial face 104 and a second or femoral face 106.

The current mechanical structure is a... ...anatomy can generally be defined by one physical A/P measurement of the patient's tibial anatomy. The appropriate thickness of the implant can be determined by measuring the amount of joint space between the femoral and tibial surface when a minor amount of valgus (heels out, knees in) is applied to the...edge of the tibial plateau and femoral condyle but have significant cartilage remaining along the tibial spine. In these instances the tibial surface of the implant may be thicker along the medial edge to accommodate the defects on the tibial plateau and enhance the stability of the device. An implant made to these specifications would be more wedge-shaped when viewed in a frontal plane, with the medial side of the implant being... ...of a specific implant size can be enlarged while maintaining the geometric area of the tibial surface. This modification of the

implant would prevent overhang of the tibial surface beyond the border of the tibial plateau while providing a larger surface area to distribute the contact loads at the femoral... ...other instances, it may be preferable to decrease the femoral surface area for a given implant size.

Degeneration in the medial compartment will cause the femoral condyle to shift towards the medial edge of the tibia such that the center of the femur is no longer directly above the center of the tibia. In some patients it may be desirable to offset the femoral surface of the implant laterally with respect to-the tibial geometry to put the femur back in a more normal alignment. Other degenerative conditions can exist which could be accommodated... ...fill in the space that results from cartilage loss on both the femoral condyle and tibial plateau. The thickness of the implant at the CSO should be approximately equal to the combined amount of cartilage loss from the two boney surfaces. When an implant of proper thickness is inserted between the femur and the tibia, the limb is restored to its proper anatomic alignment and ligament structures around the knee are retensioned.

As previously described, the implant is thicker at the posterior edge than at the CSO because it replicates the shape of the intact meniscus. In order for the implant to center itself on the surface of the tibia, the thick posterior edge of the device must be forced beyond the most distal aspect of the femur where the space between the femur and tibia is the smallest. Insertion of the implant is accomplished by forcing the medial compartment joint space open while lifting the tibia over the posterior edge of the implant. To make the insertion of the implant easier, the implant could be separated into a femoral portion and a tibial portion. The femoral portion could be positioned against the distal femur and then the tibial portion could be inserted into the knee separately. The two portions... ...between the articulation surfaces. The runner would preferably provide a slidable connection, such as a dovetail, between the two portions that would prevent them from separating.

For example, in the embodiments of Figs. 4a-4d, an implantable knee prosthesis is generally designated 400 and includes a body 402 having a substantially elliptical shape in...first portion A and a second portion B. The second portion B extends at an angle (alpha) relative to the first portion A. The additional thickness of T2 is thus medially shifted on the tibial face 404 to accommodate bone loss.

Prosthesis 400 as viewed in Fig. 4e, is similar to prosthesis 100, Fig. 1, in that a dimension D, in a range of from about .6A... ...to about .48A of the dimension F.

In another embodiment, Figs. 5a-5d disclose an implantable knee prosthesis generally designated 500 including a body 502 having a substantially elliptical shape in plan, and... ...body piece 524 includes the second face 508. The first face 504 is at an angle (alpha) relative to the second face 508.

The first body piece 522 may also have a keyed sliding interconnection with the second body piece 524. For example, a surface 526 of the first body piece 522 may... ...4a-4d and 5a-5d, the convex surface of the first face includes a contour angle (discussed above) which is substantially the same as an associated contour angle of a tibial plateau. The concave surface of the second face includes a contour angle (discussed above) which is substantially the same as an associated femoral condyle. In this manner, the first and second faces are contoured such that the prosthesis is self-centering between a tibial plateau and a femoral condyle as discussed above.

In some patients, it may be beneficial to provide an

insert different tibial and femoral surface profiles. For example, in one of the embodiments of Figs. 6a-6d, an implantable knee prosthesis 600 comprises a body 602 having a generally elliptical shape in plan including a first... ...second face 606 includes a concave surface 614.

A peripheral edge 612 extends at an incline between the first face 604 and the second face 606. As a result, the second...associated contour of a femoral condyle. In this manner, the first face 604 and the second face 606 are contoured such that the prosthesis 600 is self-centering between a tibial plateau and a femoral condyle as discussed above.

In another one of the embodiments of Figs. 7a-7d, an implantable knee prosthesis 700 comprises a body 702 having a generally elliptical shape in plan including a first... ...second face 706 includes concave surface 714.

A peripheral edge 712 extends to form a converging incline between the first face 704 and the second face 706. As a result, the first... ...associated contour of a femoral condyle. In this manner, the first face 704 and the second face 706 are contoured such that the prosthesis 700 is self-centering between a tibial plateau and a femoral condyle as discussed above.

In some patients, it may be beneficial to provide an insert which includes an enlarged femoral surface. For example, in one of the embodiments of Figs. 8a-8d, the implantable knee prosthesis 800 comprises a body 802 having a generally elliptical shape in plan including a first ... ...face 814. The second peripheral edge 812 extends radially outwardly, as indicated by a directional arrow designated R1, from the first peripheral edge 808 to form a shoulder 816 between the... ...associated contour of a femoral condyle. In this manner, the first face 810 and the second face 814 are contoured such that the prosthesis 800 is self-centering between a tibial plateau and a femoral condyle as discussed above.

The second peripheral edge 812 extends between... ...be less than the second area A2.

In the embodiments of Figs. 9a-9d, an implantable knee prosthesis 900 comprises a body 902 having a generally elliptical shape in plan including a first... ...face 914. The second peripheral edge 912 extends radially outwardly, as indicated by a directional arrow designated R2 from the first peripheral edge 908 to form a shoulder 916 between the... ...associated contour of a femoral condyle. In this manner, the first face 910 and the second face 914 are contoured such that the prosthesis 900 is self-centering between a tibial plateau and a femoral condyle as discussed above.

The first portion 904 includes a first... ...second area A2.

For example, in one of the embodiments of Figures 10a-10d, an implantable knee prosthesis 1000 comprises a two-piece body 1002 having a generally elliptical shape in plan including a first piece 1004...second face 1014 includes a concave surface 1020. The first face 1010 includes a contour angle (discussed above) which is substantially the same as an associated contour angle of a tibial plateau. The second face 1014 includes a contour angle which is substantially the same as an associated contour angle of a femoral condyle. In this manner, the first face 1010 and the second face 1014 are contoured such that the prosthesis 1000 is self-centering between a tibial plateau and a femoral condyle as discussed above.

The first piece 1004 is a tibial piece and includes a first flat interface 1023 having a linear dovetail shaped keyway 1022 formed therein. The second piece 1006 is a femoral piece and includes a second flat interface 1024 for abutting with first interface 1023 and having a linear dovetail shaped key 1026 protruding therefrom, and sized for sliding engagement within keyway 1022. In this manner, the first piece 1004 and second piece 1006 are mutually slidably engagable and separable. The linear key 1026 and the mating linear keyway 1022 permit the first and second pieces 1004, 1006, respectively, to be joined in a straight-line sliding motion.

Second piece 1006, of prosthesis 1000 as viewed in Fig. 10e, is similar to prosthesis 100, Fig. 1, in that... ...to about .48A of the dimension F.

In the embodiments of Fig. 11a-11d, an implantable knee prosthesis 1100 comprises a two-piece body 1102 having a generally elliptical shape in plan including a first piece 1104... ...second face 1114 includes a concave surface 1120. The first face 1110 includes a contour angle (discussed above) which is substantially the same as an associated contour angle of a tibial plateau. The second face 1114 includes a contour angle which is substantially the same as an associated contour angle of a femoral condyle. In this manner, the first face 1110 and the second face 1114 are contoured such that the prosthesis 1100 is self centering between a tibial plateau and a femoral condyle as discussed above.

The first piece 1104 is a tibial piece and includes a first concave interface 1123 having a concave dovetail shaped keyway 1122 formed therein. The second piece is a femoral piece and includes a second convex interface 1124 for abutting with first interface 1123 and having a convex dovetail shaped key 1126 protruding therefrom, and sized for sliding engagement within keyway 1122. In this manner, the first piece 1104 and second piece 1106 are mutually slidably engagable and separable. The concave keyway 1122 and, the convex key 1126 permit the first and second pieces 1104, 1106, respectively, to be joined in an arcuate scooping motion, i.e. the... ...the keyway 1122 in an arcuate motion.

In the embodiments of Figures 12a-12d, an implantable knee prosthesis 1200 comprises a two-piece body 1202 having a generally elliptical shape in plan including a first piece 1204... ...second face 1214 includes a concave surface 1220. The first face 1210 includes a contour angle (discussed above) which is substantially the same as an associated contour angle of a tibial plateau. The second face 1214 includes a contour angle which is substantially the same as an associated contour angle of a femoral condyle. In this manner, the first face 1210 and the second face 1214 are contoured such that the prosthesis 1200 is self centering between a tibial plateau and a femoral condyle as discussed above.

The first piece 1204 is a tibial piece and includes a first flat interface 1223 having a curved, or arcuate dovetail shaped keyway 1222 formed therein. The second piece 1206 is a femoral piece and includes a second flat interface 1224 for abutting with first interface 1223 and having a curved or arcuate dovetail shaped key 1226 protruding therefrom, and sized for sliding engagement within keyway 1222. In this manner, the first piece 1204 and second piece 1206 are mutually slidably engagable and separable. The curve of the key 1226 and the mating curve of the keyway 1222 permit the first and second pieces 1204, 1206, respectively, to be joined in an arcuate sweeping motion, i.e. the... ...rotated into the keyway 1222 in an arcuate motion.

An exemplary use of, for example, prosthesis 100 is illustrated in Fig. 13. Prosthesis 100 is positioned in a knee joint 1300 between a femur 1302, including the femoral condyles 1304, and a tibia 1306 including the tibial plateau 1308. The femur 1302 and tibia 1306 include interconnecting collateral ligaments 1310. The device 100 illustrates the position of the posterior end P, the... ...side M and the lateral side L when the device 100 is inserted in the knee joint 1300.

The prosthetic device of the subject invention is a unicompartmental device suitable for minimally invasive, surgical implantation without requiring bone resection. The device is positioned within a compartment in which a portion of the natural... ...replace the meniscus.

By the term "unicompartmental" is meant that each device is suitable for implantation into but one compartment defined by the space between a femoral condyle and its associated tibial plateau. In other words, the present device

is not a "bicompartmental" device which, in one... ...generally the medial compartment, as the meniscus and associated articular surfaces in these compartments (left knee medial and right knee medial compartments) are most subject to wear and damage. However, it is possible to insert two separate devices into the medial and lateral compartments of the same knee, or to use two such devices that are mechanically but non-rigidly linked.

The present... ...device is devoid of means of physical attachment which limit its movement (for example, screws, mating ridges and depressions, porous areas to accommodate tissue regrowth, and the like).

The term "self... ...progressively "creep" toward one side of the compartment in which it is located. Rather, the angle of attack of the femoral condyle and/or tibial plateau bearing surfaces against the device... ...articulation, maintaining the device, on average, in the same location for any given degree of knee articulation. The centered, rest, position of the implant is usually determined when the knee is in extension and there is maximum contact between the femoral condyle and the device... ...device expected to have the most wear due to either greater movement relative to the mating surface (i.e., relative to the femoral condyle or tibial plateau) or high stress, may... ...structures are used. This method may be ideal for use in conjunction with cultured chondrocyte implantation (cartilage cells used as seeds) or osteochondral transplantation. Moreover, when the locus of damage to the articular cartilage or to a portion...may have been damaged or may experience tissue degeneration. The continued load experienced at such points and the wear experienced as the knee flexes will substantially hinder the regeneration of healthy... ...than the supporting material. Rather than deforming to distribute a load relatively equally on the mating surfaces, the device of the present invention functions as a rigid, substantially non-deforming, self... ...does not necessarily spread the load uniformly, but rather may concentrate the load upon desired

points, spanning areas of imperfection. If a soft and/or low modulus elastomer or thermoplastic is...along a constant axis of rotation (90 degrees to the axis of rotation), thus the angularity of the axis of symmetry of the femoral condyle relative to the axis of symmetry of the tibial plateau is not parallel but at some acute angle. Also, the axis of symmetry of the tibial plateau is not parallel to the path of rotation of the tibia relative to the femur but also at some mildly acute angle. Thus, the true orientation of the device, regardless of the relative orientations of symmetry of... ...the knee substantially extended. The outer contours of the device are therefore designed to substantially mate with the corresponding tibial and femoral surfaces when the knee is in full extension so... ...on the surface of the tibial plateau in extension.

As the knee is flexed, the mating along the tibial surface is substantially maintained. However, the contoured mating surfaces of the femoral condyle and femoral surfaces of the present device can become increasingly... ...rotation and posterior translation of the femur with respect to the tibia. Thus, the contour angle of the femur becomes more in-line with the contour angle of the tibia in flexion. This can cause relative lateral or rotational movement, in the... ...different geometry creates a rotational moment, in the tibial plane, which is resisted along the mating tibial surfaces and which also results in a restoring force tending to correctly locate the... ...the A/P midline, thereby reducing the mismatch between the two axes in flexion. This angle is preferably 0(degree) and can range from +/- 10(degree). Anterior to the midline, the... ...that is tangent to the posterior section of the sweep plane at the most distal point of the femoral A/P radius RA. This femoral surface geometry is essentially a compromise... ...symmetry.

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## (54) Surgically implantable knee prosthesis having medially shifted tibial surface

(57) An implantable knee prosthesis includes a body having a substantially elliptical shape in plan and a pair of opposed faces. A peripheral edge of variable thickness extends between the faces and includes a first side, a second side opposite the first side, a first end and a second end opposite the first end. The thickness of the peripheral edge at the first side is greater than the thickness of the peripheral edge at the second side, the first end and the second end.

Fig. 4b

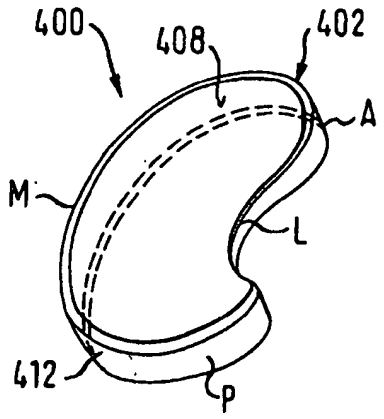


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Fig. 10a

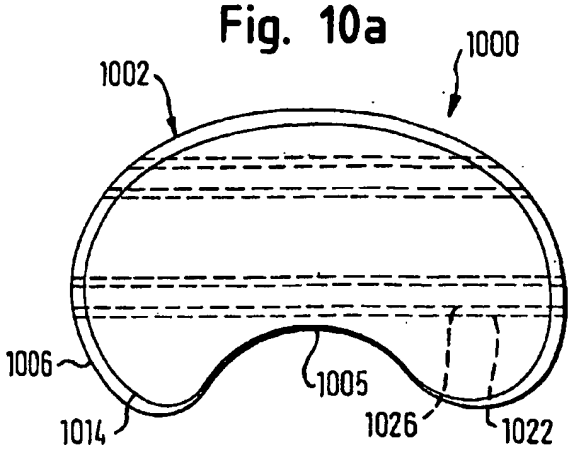



Fig. 10b

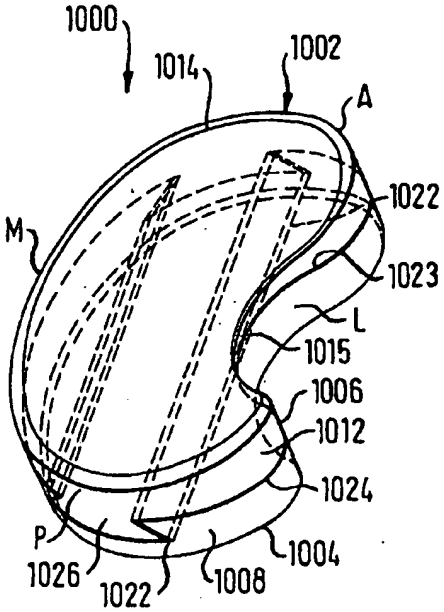



Fig. 10c

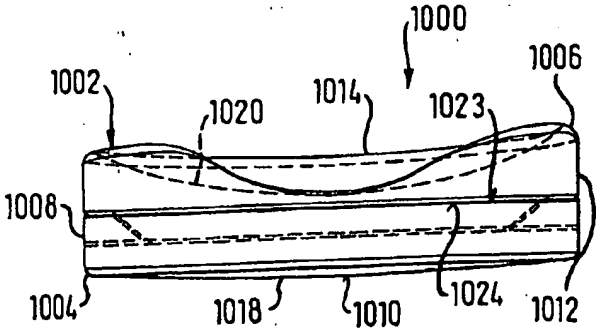
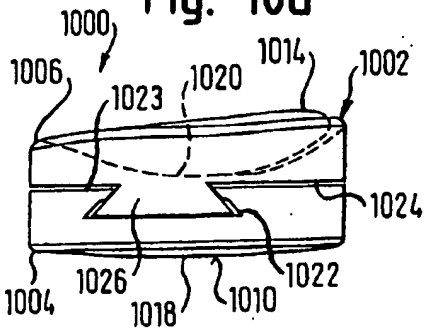



Fig. 10d



60/3K/62 (Item 62 from file: 348) **Links**
EUROPEAN PATENTS

00968512

# Tibial component of a knee prosthesis

Tibiateil einer Kniegelenkprothese
Element tibial d'une prothese du genou
Element tibial d'une prothese du genou

## Patent Assignee:

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  (applicant designated states: AT;BE;CH;CY;DE;DK;ES;FI;FR;GB;GR;IE;IT;LI;LU;MC;NL;PT;SE)

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  Urquhart-Dykes & Lord, 91 Wimpole Street; London W1M 8AH; (GB)

| | Country | Number | Kind | Date | |
|---|---|---|---|---|---|
| Patent | EP | 878177 | A2 | 19981118 | (Basic) |
| | EP | 878177 | A3 | 19990203 | |
| Application | EP | 98303098 | | 19980422 | |
| Priorities | US | 854827 | | 19970512 | |

## Designated States:

CH; DE; ES; FR; GB; LI; NL;

## International Patent Class (V7): A61F-002/38; ; ; A61F-002/38Abstract Word Count: 86

| Type | Pub. Date | Kind | Text |
|---|---|---|---|

Publication: English
Procedural: English
Application: English

| Available Text | Language | Update | Word Count |
|---|---|---|---|
| CLAIMS A | (English) | 9847 | 1264 |
| SPEC A | (English) | 9847 | 3531 |
| Total Word Count (Document A) 4795 | | | |
| Total Word Count (Document B) 0 | | | |

Total Word Count (All Documents) 4795

Specification: ...engaged by the shoulder screw which is placed through the screw receiving holes of the insert and the base plate and engaged by threads in the base plate. The tibial prosthesis is assembled by inserting the stabilizer support into the hollow stabilizer of the insert (typically a preassembled subassembly) so that the hole in the support aligns with the hole... ...engages the stop on the rail, inserting the shouldered screw through the holes in the insert and the support, and threading the screw into the threads in the base plate.

The tibial prostheses according to the invention may be made in a variety of sizes and thicknesses and stabilizer tibial insert) according to the invention;

Figure 8 is a perspective view of the lower or distal... ...17 is a broken perspective view of the upper or proximal end of an assembled tibial prosthesis according to the invention;

Figure 18 is a perspective view of the lower or distal end of the tibial prosthesis of Figure 17;

Figure 19 is a top plan view of the tibial prosthesis of Figure 17;

Figure 20 is a bottom plan view of the tibial prosthesis of Figure 17;

Figure 21 is a posterior side elevation view of the tibial prosthesis of Figure 17;and

Figure 22 is medial (or lateral) side elevation view of the tibial prosthesis of Figure 17.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to Figures 1 through 6, a tibial base plate or support member 10, according to the invention, generally includes a top or... ...and, as will be described in more detail below, forms the first part of a dovetail coupling. The rail 16 is provided with a posterior upstanding stop 18 and a posteriorly angled (approximately 121/2) anterior counterbored screw hole 20. Preferably, the stem 14 is angled posteriorly (approximately 31/2) and is buttressed by posteriorly angled (approximately 251/2) fins 22, 24. The support member 10 is preferably made of a cobalt chrome (Vitallium) alloy.

Turning now to Figures 7 through 12, a stabilizer tibial insert (bearing support member) 30 is a symmetrical plastic (UHMWPE) member having two upper or proximal... ...best in Figures 7, 8, and 11, the lower or distal surface 40 of the insert 30 is substantially bisected by a distally tapered groove 42 which is dimensioned to mate with the proximally flared rail 16 of the base plate 10 described above, and which forms the second part of a dovetail coupling. A posterior portion of the groove 42 is provided with a stop receiving slot 44... ...a posterior upstanding portion 54. The base portion 52 is provided with a shouldered posteriorly angled (approximately 121/2) anterior screw hole 56. The base portion 52 is dimensioned to fit... ...17-22, those skilled in the art will appreciate that the aforedescribed components (baseplate 10, insert 30, and support 50) are easily assembled to form a tibial prosthesis 100 which is shown in Figures 17-22. As seen best in Figures 17 and...portion 20a which receives the shoulder of the screw 60, and a lower or distal narrow threaded portion 20b which receives and engages the threaded portion of the screw 60. As... ...stem 14.

From the foregoing, those skilled in the art will appreciate that the central dovetail coupling of the insert 30 to the baseplate 10 will provide excellent torsional as well as vertical retention of... ...deformation of the insert as is required in many of the prior art devices. The coupling of the insert to the base plate also does not interfere with

the thickness of the bearing portions of the insert.

As mentioned above, the tibial prosthesis of the invention may be made in several different sizes. According to one exemplary embodiment... ...of the stop 18 is approximately .286 inches relative to the supporting surface 12. The angle of the flare in the rail 16 is preferably approximately 601/2. The stem 14... ...According to the exemplary embodiment, the thickness of the bearing portions 32, 34 of the insert 30 (at pre-established gauge points) will range from approximately .430 inches to approximately .247 inches. In this embodiment, the overall... ...diameter of approximately .239 inches.

There have been described and illustrated herein components of a tibial prosthesis and an assembled tibial prosthesis. While particular embodiments of the invention have been described, it is not intended that the... ...been disclosed, it will be appreciated that other dimensions could be utilized. Also, while particular angles have been shown, it will be recognized that other angles could be used with similar results obtained. Moreover, while particular configurations have been disclosed in...

US005824103A

# United States Patent [19]

Williams

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[45] Date of Patent: Oct. 20, 1998

[54] TIBIAL PROSTHESIS

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[73] Assignee: Howmedica Inc.

[21] Appl. No.: 854,827

[22] Filed: May 12, 1997

[51] Int. Cl.[6] ..... A61F 2/38

[52] U.S. Cl. ..... 623/20

[58] Field of Search ..... 623/20

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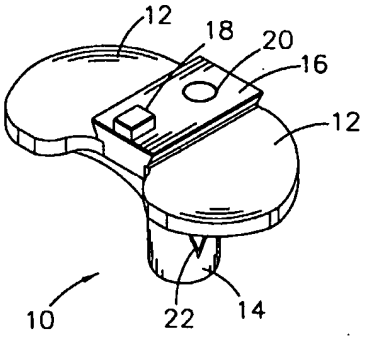
*Primary Examiner*—Michael J. Milano

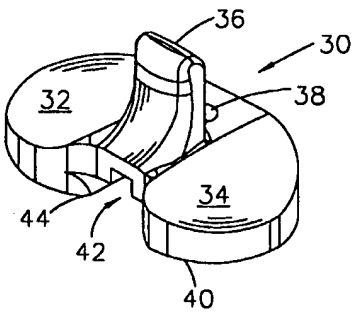
*Attorney, Agent, or Firm*—Joseph J. Kaliko

[57] ABSTRACT

A tibial prosthesis includes a base support member, a bearing surface member, a stabilizer insert support, and a shoulder screw. The base member has a centrally located proximally flared protrusion or rail which extends substantially from the anterior edge of the base support member to the posterior edge of the base support member and defines a pair of substantially parallel dovetail coupling edges. An upstanding posterior stop is located on the upper surface of the rail adjacent its posterior edge and a posteriorly angled screw hole is provided in an anterior portion of the rail. The bearing member has a lower distally tapered recess or groove, dimensioned to receive the rail on the base member, and a posterior stop receiving recess for permitting the posterior stop on the base member rail to engage the insert support. A hollow upstanding stabilizer is formed on a central portion of the bearing member and a hole is provided anterior of the stabilizer. The stabilizer insert support is generally L-shaped and dimensioned to fit inside the hollow stabilizer portion of the bearing member. The base of the stabilizer insert is provided with a counterbored hole to be engaged by the shoulder screw which is placed through the screw receiving holes of the bearing member and the base member and engaged by threads in the base member.

**23 Claims, 7 Drawing Sheets**



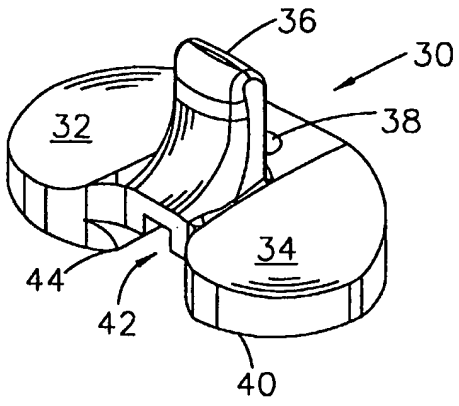



FIG. 7

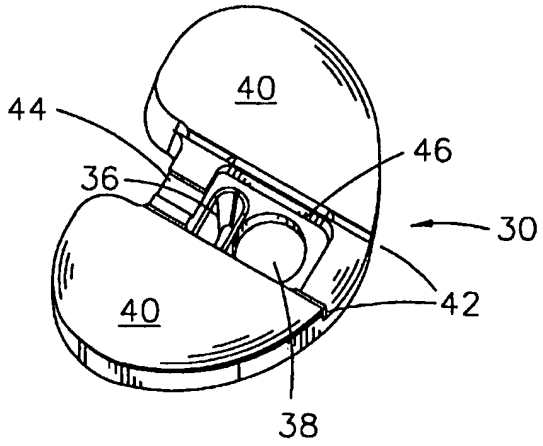



FIG. 8

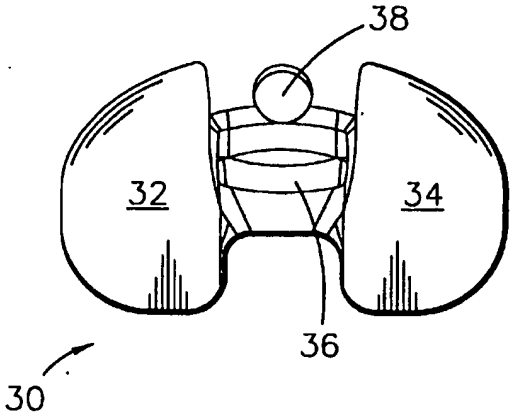



FIG. 9

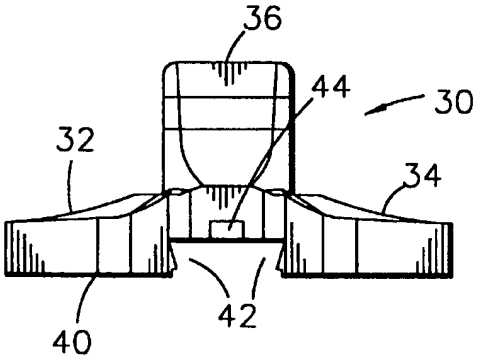



FIG. 11

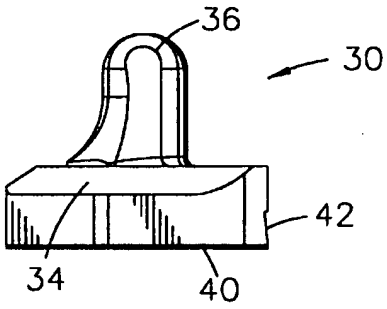



FIG. 12

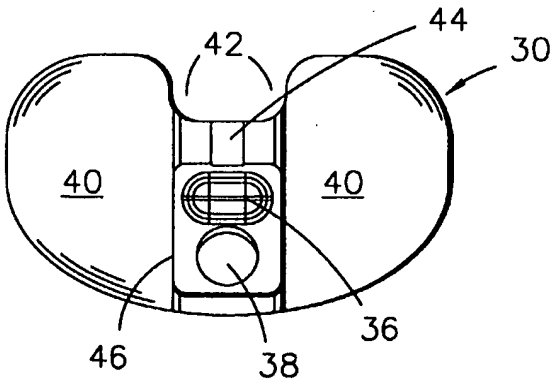



FIG. 10.

FIG. **20** is a bottom plan view of the tibial prosthesis of FIG. **17**;

FIG. **21** is a posterior side elevation view of the tibial prosthesis of FIG. **17**;and

FIG. **22** is medial (or lateral) side elevation view of the tibial prosthesis of FIG. **17**.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIGS. **1** through **6**, a tibial base plate or support member **10**, according to the invention, generally includes a top or proximal symmetrical supporting surface **12** and a lower or distal mounting stem **14**. The upper surface **12** is substantially bisected by a proximally flared protrusion or rail **16** which extends substantially the entire anterior-posterior width of the base plate and, as will be described in more detail below, forms the first part of a dovetail coupling. The rail **16** is provided with a posterior upstanding stop **18** and a posteriorly angled (approximately 12½) anterior counterbored screw hole **20**. Preferably, the stem **14** is angled posteriorly (approximately 3½) and is buttressed by posteriorly angled (approximately 25½) fins **22**, **24**. The support member **10** is preferably made of a cobalt chrome (Vitallium) alloy.

Turning now to FIGS. **7** through **12**, a stabilizer tibial insert (bearing support member) **30** is a symmetrical plastic (UHMWPE) member having two upper or proximal bearing support surfaces **32**, **34** which conform to the distal condyles of a femoral member (not shown), and a centrally located upstanding hollow stabilizer **36** which is dimensioned to serve as a substitute for the posterior cruciate ligament. A screw receiving hole is provided anterior of the stabilizer **36**. As seen best in FIGS. **7**, **8**, and **11**, the lower or distal surface **40** of the insert **30** is substantially bisected by a distally tapered groove **42** which is dimensioned to mate with the proximally flared rail **16** of the base plate **10** described above, and which forms the second part of a dovetail coupling. A posterior portion of the groove **42** is provided with a stop receiving slot **44** which allows the insert **30** to pass over the stop **18** on the baseplate **10** ((FIG. **1**) as will be described in more detail below. In addition, an insert support receiving well **46** is provided in an area of the groove **42** surrounding the lower hollow access to the stabilizer **36** and the screw hole **38**. As will be described in more detail below, this well **46** is dimensioned to receive the base portion of the metallic stabilizer support member.

As mentioned above, the stabilizer insert **30** is intended to be used with a metallic (preferably cobalt chrome alloy) support member. FIGS. **13–16** illustrate a support member **50** according to the invention. The support member **50** is substantially L-shaped having a base portion **52** and a posterior upstanding portion **54**. The base portion **52** is provided with a shouldered posteriorly angled (approximately 12½) anterior screw hole **56**. The base portion **52** is dimensioned to fit within the well **46** of the insert **30** (FIG. **8**) with the upstanding portion **54** extending into the hollow stabilizer **36** and the hole **56** aligned with the hole **38**.

From the foregoing, and with reference to FIGS. **17–22**, those skilled in the art will appreciate that the aforedescribed components (baseplate **10**, insert **30**, and support **50**) are easily assembled to form a tibial prosthesis **100** which is shown in FIGS. **17–22**. As seen best in FIGS. **17** and **22**, the first step in the assembly is to place the upstanding portion **54** of the support **50** into the hollow stabilizer **36** of the insert **30** so that the base portion **52** of the support **50** is received in the well **46** of the insert **30** and the hole **56** in the support **50** aligns with the hole **38** in the insert **30**. The subassembly resulting from the first step in the assembly process being described is generally made available as a preassembly.

Next, as seen best in FIGS. **17** and **21**, the insert **30**, carrying the support **50**, is positioned so that its posterior end faces the anterior end of the baseplate **10** and the groove **42** in the insert **30** is aligned with the rail **16** on the baseplate **10**. The insert **30** is pushed posteriorly so that the rail **16** is embraced by the groove **42** and the base portion **52** of the support **50** abuts the stop **18** on the baseplate rail **16**. The stop **18** prevents further posterior movement of the insert **30** and stops the insert **30** at a location where the hole **38** in the insert and the hole **56** in the support **50** are aligned with the hole **20** in the baseplate **10**. With the components **10**, **30**, and **50** so arranged, a hexagon socket head shoulder screw **60** is inserted into the holes **38**, **56**, **20** and is screwed into threaded engagement with the baseplate **10**. As seen best in FIGS. **17** and **22**, the hole **20** in the baseplate **10** has a broad unthreaded upper or proximal portion **20***a* which receives the shoulder of the screw **60**, and a lower or distal narrow threaded portion **20***b* which receives and engages the threaded portion of the screw **60**. As shown in the Figures, the stem **14** of the baseplate **10** is provided with a threaded stem cap **70**. This cap may be removed so that a stem extension can be added to stem **14**.

From the foregoing, those skilled in the art will appreciate that the central dovetail coupling of the insert **30** to the baseplate **10** will provide excellent torsional as well as vertical retention of the insert. The use of the shoulder screw **60**, rather than a conventional socket head screw, provides an added benefit that, in addition to anterior-posterior retention of the insert, the screw is highly resistant to posteriorly applied shear loading. The increased resistance to shear loading is achieved by the larger diameter shoulder portion of the screw **60** and the lack of stress risers which are found in conventional screws due to their thread configuration. Furthermore, the prosthesis **100** is very easy to assemble and does not require very careful positioning of the components at the time of the assembly. Assembly does not require deformation of the insert as is required in many of the prior art devices. The coupling of the insert to the base plate also does not interfere with the thickness of the bearing portions of the insert.

As mentioned above, the tibial prosthesis of the invention may be made in several different sizes. According to one exemplary embodiment, the baseplate **10** has a medial-lateral width of approximately 2.44 inches and an anterior-posterior width of approximately 1.44 inches. In this embodiment, the thickness of the base plate at the supporting surface **12** is approximately 0.117 inches, the height of the rail **16** is approximately 0.173 inches, and the height of the stop **18** is approximately 0.286 inches relative to the supporting surface **12**. The angle of the flare in the rail **16** is preferably approximately 60½. The stem **14** is approximately 1.18 inches long and has an outer diameter of approximately 0.525 inches. The insert **30** will have corresponding dimensions to fit on the baseplate **10**. According to the exemplary embodiment, the thickness of the bearing portions **32**, **34** of the insert **30** (at pre-established gauge points) will range from approximately 0.430 inches to approximately 0.247 inches. In this embodiment, the overall height of the insert (including the stabilizer **36**) is approximately 1.174 inches. The support **50** used in the exemplary embodiment has an overall height of approximately 0.748 inches. The base portion of the support is approximately 0.505 inches by 0.729 inches and the diameter of the hole in

the base portion is stepped from approximately 0.356 inches to approximately 0.258 inches. The shoulder screw **60** in this embodiment is approximately 0.635 inches long with a threaded length of approximately 0.220 inches and a shoulder diameter of approximately 0.239 inches.

There have been described and illustrated herein components of a tibial prosthesis and an assembled tibial prosthesis. While particular embodiments of the invention have been described, it is not intended that the invention be limited thereto, as it is intended that the invention be as broad in scope as the art will allow and that the specification be read likewise. Thus, while particular dimensions have been disclosed, it will be appreciated that other dimensions could be utilized. Also, while particular angles have been shown, it will be recognized that other angles could be used with similar results obtained. Moreover, while particular configurations have been disclosed in reference to the stop, it will be appreciated that other configurations could be used as well. Furthermore, while the prosthesis has been disclosed as being made from particular materials, it will be understood that different materials can achieve the same or similar function as disclosed herein. It will therefore be appreciated by those skilled in the art that yet other modifications could be made to the provided invention without deviating from its spirit and scope as so claimed.

What is claimed is:

**1**. A tibial prosthesis comprising:

a) a base support member having a proximal supporting surface and a single integrally formed centrally located proximally flared protrusion which substantially bisects said supporting surface; and

b) a bearing surface member having a pair of proximal bearing surfaces and a single distal distally tapered groove, said distally tapered groove dimensioned to slideably embrace said single integrally formed centrally located proximally flared protrusion.

**2**. A tibial prosthesis according to claim **1** wherein said single integrally formed centrally located proximally flared protrusion defines a pair of substantially parallel dovetail coupling edges.

**3**. A tibial prosthesis according to claim **1** wherein said base support member has a first screw receiving hole located in an anterior portion of said single integrally formed centrally located proximally flared protrusion, and said bearing surface member has an anterior second screw receiving hole which is aligned with said first screw receiving hole when said single distal distally tapered groove embraces said single integrally formed centrally located proximally flared protrusion.

**4**. A tibial prosthesis according to claim **3** further comprising:

c) a shoulder screw dimensioned to pass through said second screw receiving hole and to engage threads in said first screw receiving hole.

**5**. A tibial prosthesis according to claim **4** wherein said bearing surface member has a centrally located upstanding hollow stabilizer.

**6**. A tibial prosthesis according to claim **5** further comprising:

d) a substantially L-shaped support member having a base portion and an upstanding portion, said base portion including a counterbored third screw receiving hole and said upstanding portion dimensioned to fit inside said hollow stabilizer, wherein said shoulder screw is dimensioned to engage said base portion via said third screw receiving hole.

**7**. A tibial prosthesis according to claim **6** wherein said single integrally formed centrally located proximally flared protrusion has an upstanding posterior stop which abuts said support member when said first, second and third screw receiving holes are aligned.

**8**. A tibial prosthesis comprising:

a) a base support member having a proximal supporting surface, a single integrally formed centrally located first dovetail coupling which substantially bisects said supporting surface, and an anterior first screw receiving hole having a distal threaded portion and a proximal unthreaded portion;

b) a bearing surface member having a pair of proximal bearing surfaces, a single distal second dovetail coupling, and an anterior second screw receiving hole, said single distal second dovetail coupling being dimensioned to mate with said single integrally formed centrally located first dovetail coupling with said first and second screw receiving holes being aligned with each other; and

c) a shoulder screw dimensioned to pass through said second screw receiving hole and engage said distal threaded portion of said first screw receiving hole.

**9**. A tibial prosthesis according to claim **8** wherein said bearing surface member has a centrally located upstanding hollow stabilizer.

**10**. A tibial prosthesis according to claim **9** further comprising:

d) a substantially L-shaped support member having a base portion and an upstanding portion, said base portion including a counterbored third screw receiving hole and said upstanding portion dimensioned to fit inside said hollow stabilizer, wherein said shoulder screw is dimensioned to engage said base portion via said third screw receiving hole.

**11**. A tibial prosthesis according to claim **10** wherein said single integrally formed centrally located first dovetail coupling has an upstanding posterior stop which abuts said support member when said first, second and third screw receiving holes are aligned.

**12**. A tibial prosthesis comprising:

a) a base support member having a proximal supporting surface and a centrally located first dovetail coupling with an upstanding posterior stop;

b) a bearing surface member having a pair of proximal bearing surfaces, an upstanding hollow stabilizer, and a centrally located distal second dovetail coupling, said second dovetail coupling dimensioned to slideably embrace said first dovetail coupling; and

c) a stabilizer support member dimensioned to fit inside said upstanding hollow stabilizer and abut said posterior stop when said second dovetail coupling slideably embraces said first dovetail coupling.

**13**. A tibial insert for use with a tibial baseplate having a proximal supporting surface and a single integrally formed centrally located proximally flared protrusion which substantially bisects said supporting surface, said insert comprising a bearing surface member having a pair of proximal bearing surfaces and a single distal distally tapered groove, said single distally tapered groove dimensioned to slideably embrace said single integrally formed centrally located proximally flared protrusion.

**14**. A tibial insert according to claim **13** wherein said bearing surface member has a centrally located upstanding hollow stabilizer and an anterior screw receiving hole.

**15**. A tibial base plate for use with a tibial insert having a pair of proximal bearing surfaces and a single distal

distally tapered groove, said base plate comprising a base support member having a proximal supporting surface and a single integrally formed centrally located proximally flared protrusion which substantially bisects said supporting surface and which is dimensioned to slideably embrace said distally tapered groove.

**16**. A tibial base plate according to claim **15** further comprising an upstanding stop located on a posterior portion of said single integrally formed centrally located proximally flared protrusion.

**17**. A tibial base plate according to claim **15** wherein said single integrally formed centrally located proximally flared protrusion has an anterior screw receiving hole, said hole having a distal threaded portion and a proximal unthreaded portion.

**18**. A tibial base plate according to claim **17** wherein said screw receiving hole is dimensioned to receive a shoulder screw.

**19**. A method for assembling a tibial prosthesis comprising the steps of:

a) obtaining a base support member having a proximal supporting surface and a single integrally formed centrally located proximally flared protrusion which substantially bisects said supporting surface;

b) obtaining a bearing surface member having a pair of proximal bearing surfaces and a single distally tapered groove; and

c) sliding the bearing surface onto the base support member so that the single distally tapered groove embraces said single integrally formed centrally located proximally flared protrusion.

**20**. A method for assembling a tibial prosthesis comprising the steps of:

a) obtaining a base support member having a proximal supporting surface, a single integrally formed centrally located first dovetail coupling which substantially bisects said supporting surface, and an anterior first screw receiving hole having a distal threaded portion and a proximal unthreaded portion;

b) obtaining a bearing surface member having a pair of proximal bearing surfaces, a single distal second dovetail coupling, and an anterior second screw receiving hole;

c) obtaining a shoulder screw dimensioned to pass through the second screw receiving hole and engage the distal threaded portion at the first screw receiving hole;

d) sliding the bearing surface member onto the base support member such that said second dovetail coupling mates with said single integrally formed centrally located first dovetail coupling and the first and second screw receiving holes are aligned with each other;

e) inserting the shoulder screw through the first and second screw receiving holes; and

f) threading the screw into the threaded portion of the first screw receiving hole.

**21**. A method according to claim **20** further comprising the steps of:

g) obtaining a substantially L-shaped support member having a base portion and an upstanding portion, the base portion including a counterbored third screw receiving hole, the bearing surface member having a hollow stabilizer portion dimensioned to receive the upstanding portion; and

h) prior to said step of sliding, inserting the upstanding portion of the support member into the stabilizer portion so that the third screw receiving hole is aligned with the second screw receiving hole.

**22**. A method for assembling a tibial prosthesis comprising the steps of:

a) obtaining a base support member having a proximal supporting surface, a single integrally formed centrally located first dovetail coupling which substantially bisects said supporting surface and an upstanding posterior stop;

b) obtaining a bearing surface member having a pair of proximal bearing surfaces, an upstanding hollow stabilizer, and a single centrally located distal second dovetail coupling;

c) obtaining a stabilizer support member dimensioned to fit inside said upstanding hollow stabilizer;

d) inserting said stabilizer support member into said hollow stabilizer; and

e) sliding the bearing surface member onto said base support member so that said single centrally located second dovetail coupling embraces said single integrally formed centrally located first dovetail coupling and said stabilizer support abuts said posterior stop.

**23**. A method for assembling a tibial prosthesis, comprising the steps of:

a) obtaining a base support member having a proximal supporting surface and a centrally located first dovetail coupling with an upstanding posterior stop;

b) obtaining a bearing surface member having a pair of proximal bearing surfaces, an upstanding hollow stabilizer having a stabilizer support member inserted therein, and a centrally located distal second dovetail coupling; and

c) sliding the bearing surface member onto the base support member so that second dovetail coupling embraces the first dovetail coupling and the stabilizer support abuts the posterior stop.

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EUROPEAN PATENTS

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# Modular prosthetic knee implant system comprising femoral stem augment

Modulares Knieprothesensystem mit Zwischenelement fur Oberschenkelschaft
Systeme modulaire d'implant du genou avec piece intermediaire pour une tige femorale
Systeme modulaire d'implant du genou avec piece intermediaire pour une tige femorale

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The present invention relates to modular components of a prosthetic joint, and more particularly to modular components of a prosthetic knee joint.

The knee joint basically consists of the bone interface of the distal end of the femur and the proximal end of the tibia. Appearing to cover or at least partially protect this interface is the patella, which is a sesamoid bone within the tendon of the long muscle (quadriceps) on the front of the thigh. This tendon inserts into the tibial tuberosity and the posterior surface of the patella is smooth and glides over the femur.

The femur is configured with two knob like processes (the medial condyle and the lateral condyle), which... ...slightly cupped thereby providing a slight receptacle for receipt of the femoral condyles.

When the knee joint is injured whether as a result of an accident or illness, a prosthetic replacement of the damaged joint may be necessary to relieve pain and to restore normal use... ...means of a surgical procedure, which involves removal of the ends of the corresponding damaged bones and replacement of these ends with prosthetic implants. This replacement of a native joint with a prosthetic joint is referred to as a primary total-knee arthroplasty.

Prosthetic knee implants include femoral implants that are designed to be affixed to the distal end of the resected femur. A known modular femoral implant is illustrated in FIGS. 1-3. As there shown, the modular femoral implant 10 includes a femoral component 12, an elongate stem member 14, bolt 16 (shown in... ...portions 20, 22 with articulating surfaces 24, 26 to engage an articulating surface of a tibial implant (not shown). On the proximal side of the femoral component 12, the two condylar portions... ...outer surfaces.

As shown in FIG. 2, when assembled, the stem member 14 is typically angled in a medial direction. The angle is labelled in FIG. 2 as (alpha). The angle (alpha) is between the axis 40 of the stem member 14 and a line 41... ...of the seating or mounting platform 34 of the intercondylar pad or box 28. The angle (alpha) corresponds with the valgus angle when the implant assembly is implanted; the valgus angle is defined as the angle between the centre line of the femur and the vertical axis connecting the distal femur and the centre of the femoral head... ...head will correspond with the line 41.

In the illustrated prior art modular assembly, the angle (alpha) is set by the structure of the femoral stem collar 18. The femoral stem... ...a plane and an inferior side or surface 35 lying in a plane that is not parallel to the plane of the superior side or surface 33. The inferior surface of the collar is angled, defining an obtuse angle (90(degree) + (alpha) ) with the axis 40 of the stem. In typical implant sets, a plurality of femoral stem collars 18 are provided, shaped so that the angle (alpha) can be set to be any one of a number of angles. In one implant set available from DePuy Orthopaedics, Inc. of Warsaw, Indiana, the femoral stem collars are shaped to define angles (alpha) of either 5(degree) or 7(degree), but angles (alpha) may be in a typical range of 5 to 9(degree).

Although not shown... ...of the bolt 16. The central bore has a central longitudinal axis defining an obtuse angle with at least one of the plane of the superior side 33 and inferior side 35 of the stem collar 18.

To ensure that the angle (alpha) remains in the illustrated orientation, the intercondylar box or pad 28 typically has a pair of anti-rotation tabs 46, 48 (see FIGS. 1 and 3) that mate with opposing flats 50, 52 on the femoral stem collars 18.

As commercially supplied, the ... ...6126693.

Although known systems versatile and economic, in some instances, it may be desirable to implant the femoral components with a neutral valgus angle.

The present invention provides an enhancement to prior art implant systems by allowing for setting the femoral stem member of a modular implant assembly at a neutral valgus angle.

In one aspect, the invention provides a modular prosthetic knee implant system comprising:

a femoral component including a pair of condylar portions and an intercondylar portion having a mounting platform;

a stem member;

a ... ...are capable of being assembled so that the stem member is in a first fixed angular relationship with the mounting platform; and

wherein the femoral component, stem member, stem collar, and... ...are capable of being assembled so that the stem member is in a second fixed angular relationship with the mounting platform.

In another aspect, the invention provides a modular prosthetic knee implant system comprising:

a femoral component having a pair of condylar portions and an intercondylar portion having a mounting platform, at least part of... ...of the superior side and at least part of the inferior side lying in separate non-parallel planes, the stem collar further having a bore extending from the superior side to the inferior side, the bore having a central

longitudinal axis defining an obtuse angle with at least one of the plane of the superior side and the plane of... ...part the superior side and at least part of the inferior side lying in separate non-parallel planes, the augment having a bore extending from the superior side to the inferior side, the bore having a central longitudinal axis defining an obtuse angle with at least one of the plane of the superior side and the plane of... ...inferior side;

the stem collar, augment and mounting platform of the femoral component further including mating anti-rotation members.

In a further aspect, the invention provides a modular augment for use with a prosthetic knee implant comprising:

a body including a superior side and an inferior side,

at least a portion... ...side to the inferior side;

the bore having a central longitudinal axis defining an obtuse angle with at least one of the superior plane and inferior plane.

In yet another aspect, the invention provides a prosthetic knee implant comprising:

a femoral component including a pair of condylar portions and an intercondylar portion having a mounting platform with an opening;

an ... ...collar to the stem member.

The invention can therefore been viewed as providing a modular prosthetic knee implant system comprising a femoral component, a stem member, a stem collar and an augment. The... ...are capable of being assembled so that the stem member is in a first fixed angular relationship with the mounting platform. The femoral component, stem member, stem collar, and augment are also capable of being assembled so that the stem member is in a second fixed angular relationship with the mounting platform.

The invention can also be viewed as providing a modular prosthetic knee implant system comprising a femoral component, a stem member, a stem collar, and an augment. The... ...of the superior side and at least part of the inferior side lie in separate non-parallel planes. The stem collar also has a bore extending from the superior side to the inferior side; the bore has a central longitudinal axis that defines an obtuse angle with at least one of the plane of the superior side and the plane of... ...side and at least part of the inferior side of the augment lie in separate non-parallel planes. The augment also has a bore extending from the superior side to the inferior side; the bore has a central longitudinal axis that defines an obtuse angle with at least one of the plane of the superior side and the plane of... ...inferior side. The stem collar, augment and mounting platform of the femoral component further include mating anti-rotation members.

The invention can also be viewed as providing a modular augment for use with a prosthetic knee implant. The modular augment has a body with a superior side and an inferior side. At... ...side of the augment. The bore has a central longitudinal axis that defines an obtuse angle with at least one of the superior plane and inferior plane.

The invention can also be viewed as providing a prosthetic knee implant comprising a femoral component, an augment, a stem collar, a stem and a bolt. The... ...the posterior side;

FIG. 3 is an exploded view of the prior art modular femoral implant of FIGS. 1-2;

FIG. 4 is a perspective view of a femoral stem augment incorporating the principles of... ...The femoral stem augment 60 of the present invention may be used with commercially available prosthetic knee components, as shown in FIGS. 8-12, where the same reference numbers for prior art... ...augment 60 lies in a superior plane and the inferior side 64 lies in a non-parallel inferior plane. The femoral stem augment has a central opening 66 in the superior side... ...6-7. As there shown, the superior surface 62 of the augment 60 defines an angle (theta) with the inferior surface 64. The angle (theta) corresponds with one of the valgus angles provided by the femoral stem collars 18. For example, if an implant kit includes femoral stems and collars 18 defining angles of 5(degree) and 7(degree), then the stem augment 60 should be provided to define a counter angle of either 5(degree) and 7(degree). Although a kit could include stem augments 60 of both angles, only one set of augments with one angle should be necessary since the kit would generally include a complete set of stem members... ...the bore or channel 72 has a central longitudinal axis 90 that defines an obtuse angle with at least one of the superior plane 92 and inferior plane 94 of the... ...components share a single co-linear central longitudinal axis 90 that also defines an obtuse angle with respect to the plane of the inferior surface 33 of the stem collar 18... ...anti-rotation flats 68, 69 of the illustrated femoral stem augment 60 are defined by

undercuts 80, 82 in the femoral stem augment 60 beneath the tabs 70, 71. The inferior... ...to each other, and are positioned opposite to one another in the illustrated embodiment. The undercuts 80, 82 are aligned with the tabs 70, 71, each undercut lying between one tab and the inferior plane 94 of the body 61 of the... ...femoral stem members 14, femoral collars 18 and femoral components 12, as well as the tibial and patellar implants, can be those commercially available from DePuy Orthopaedics, Inc. of Warsaw, Indiana, sold under the trade marks PFC SIGMA and PFC SIGMA RP ... ...finishes. The modified system would also include one or more stem augments 60 defining an angle (theta) of corresponding with one of the angles (alpha). However, it should be understood that the present invention is not limited to any... ...the surgeon can prepare the proximal end of the tibia and distal end of the femur in the standard manner, and resect these bones in the standard manner to receive the prosthetic components. As part of this process, the surgeon can ream the femoral intramedullary canal to... ...can assemble the prior art components as shown in FIGS. 1-3, with the femoral implant defining a valgus angle of 5(degree)-9(degree). If the patient's anatomy makes such a standard implant... ...assembly can be used whether the implant system will be used to define a valgus angle or whether a neutral axis is desired.

If a neutral axis is desired and the stem augment 60 of the system has an angle (theta) of 5(degree), then a stem/collar sub-assembly with an angle (alpha) of 5(degree) is selected. The length and other characteristics of the stem member... ...stem augment 60 is aligned so that the anti-rotation surfaces 68, 69 of its undercuts 80, 82 are received against the tabs 46, 48 of the intercondylar box 28 to... ...the use of flats and tabs, other arrangements can be used, such as pegs and mating holes.

It should be understood that the same system could be used for patient's requiring a standard valgus angle. The surgeon can decide intraoperatively to assemble the femoral component with a stem/collar sub... ...The augment 60 of the present invention can be made of any conventional material for orthopaedic implants, such as cobalt-chrome steel or titanium, or any other material that is in current orthopaedic use or becomes used in orthopaedic applications. The augment 60 can be made using standard...

Specification: ...inferior side; the stem collar, augment and mounting platform of the femoral component further including mating anti-rotation members.

The invention can therefore been viewed as providing a modular prosthetic knee implant system comprising a femoral component, a stem member, a stem collar and an augment. The ... ...are capable of being assembled so that the stem member is in a first fixed angular relationship with the mounting platform. The femoral component, stem

member, stem collar, and augment are also capable of being assembled so that the stem member is in a second fixed angular relationship with the mounting platform.

The invention can also be viewed as providing a modular prosthetic knee implant system comprising a femoral component, a stem member, a stem collar, and an augment. The... ...of the superior side and at least part of the inferior side lie in separate non-parallel planes. The stem collar also has a bore extending from the superior side to the inferior side; the bore has a central longitudinal axis that defines an obtuse angle with at least one of the plane of the superior side and the plane of... ...side and at least part of the inferior side of the augment lie in separate non-parallel planes. The augment also has a bore extending from the superior side to the inferior side; the bore has a central longitudinal axis that defines an obtuse angle with at least one of the plane of the superior side and the plane of... ...inferior side. The stem collar, augment and mounting platform of the femoral component further include mating anti-rotation members.

The invention can also be viewed as providing a modular augment for use with a prosthetic knee implant. The modular augment has a body with a superior side and an inferior side. At... ...side of the augment. The bore has a central longitudinal axis that defines an obtuse angle with at least one of the superior plane and inferior plane.

The invention can also be viewed as providing a prosthetic knee implant comprising a femoral component, an augment, a stem collar, a stem and a bolt. The... ...the posterior side;

FIG. 3 is an exploded view of the prior art modular femoral implant of FIGS. 1-2;

FIG. 4 is a perspective view of a femoral stem augment incorporating the principles of... ...The femoral stem augment 60 of the present invention may be used with commercially available prosthetic knee components, as shown in FIGS. 8-12, where the same reference numbers for prior art... ...augment 60 lies in a superior plane and the inferior side 64 lies in a non-parallel inferior plane. The femoral stem augment has a central opening 66 in the superior side... ...6-7. As there shown, the superior surface 62 of the augment 60 defines an angle theta with the inferior surface 64. The angle theta corresponds with one of the valgus angles provided by the femoral stem collars 18. For example, if an implant kit includes femoral stems and collars 18 defining angles of 5(deg) and 7(deg), then the stem augment 60 should be provided to define a counter angle of either 5(deg) and 7(deg). Although a kit could include stem augments 60 of both angles, only one set of augments with one angle should be necessary since the kit would generally include a complete set of stem members... ...the bore or channel 72 has a central longitudinal axis 90 that defines an obtuse angle with at least one of the superior plane 92 and inferior plane 94 of the... ...components share a single co-linear central longitudinal axis 90 that also defines an obtuse angle with respect to the plane of the inferior surface 33 of the stem collar 18... ...anti-rotation flats 68, 69 of the illustrated femoral stem augment 60 are defined by undercuts 80, 82 in the femoral stem augment 60 beneath the tabs 70, 71. The inferior... ...to each other, and are positioned opposite to one another in the illustrated embodiment. The undercuts 80, 82 are aligned with the tabs 70, 71, each undercut lying between one tab and the inferior plane 94 of the body 61 of the... ...femoral stem members 14, femoral collars 18 and femoral components 12, as well as the tibial and patellar implants, can be those commercially available from DePuy Orthopaedics, Inc. of Warsaw, Indiana, sold under the trade marks PFC SIGMA and PFC SIGMA RP ... ...finishes. The modified system would also include one or more stem augments 60 defining an angle theta of corresponding with one of the angles alpha. However, it should be understood that the present invention is not limited to any... ...the surgeon can prepare the proximal end of the tibia and distal end of the femur in the standard manner, and resect these bones in the standard manner to receive the prosthetic components. As part of this process, the surgeon can ream the femoral intramedullary canal to... ...can assemble the prior art components as shown in FIGS. 1-3, with the femoral implant defining a valgus angle of 5(deg)-9(deg). If the patient's anatomy makes such a standard implant... ...assembly can

be used whether the implant system will be used to define a valgus angle or whether a neutral axis is desired.

If a neutral axis is desired and the stem augment 60 of the system has an angle theta of 5(deg), then a stem/collar sub-assembly with an angle alpha of 5(deg) is selected. The length and other characteristics of the stem member... ...stem augment 60 is aligned so that the anti-rotation surfaces 68, 69 of its undercuts 80, 82 are received against the tabs 46, 48 of the intercondylar box 28 to... ...the use of flats and tabs, other arrangements can be used, such as pegs and mating holes.

It should be understood that the same system could be used for patient's requiring a standard valgus angle. The surgeon can decide intraoperatively to assemble the femoral component with a stem/collar sub... ...The augment 60 of the present invention can be made of any conventional material for orthopaedic implants, such as cobalt-chrome steel or titanium, or any other material that is in current orthopaedic use or becomes used in orthopaedic applications. The augment 60 can be made using standard...

Claims: ...A1

1. A prosthetic knee implant including a modular augment comprising:

a body including a superior side and an inferior side... ...the inferior side, in which the bore has a central longitudinal axis defining an obtuse angle with at least one of the superior plane and inferior plane.

2. The prosthetic knee implant of claim 1 further comprising:

a femoral component including a pair of condylar portions and... ...member; and

a stem collar having a superior side and an inferior side.

3. The prosthetic knee implant of claim 2 wherein:

the femoral component, stem member and stem collar are capable of being assembled so that the stem member is in a first fixed angular relationship with the mounting platform; and

wherein the femoral component, stem member, stem collar, and... ...are capable of being assembled so that the stem member is in a second fixed angular relationship with the mounting platform.

4. The prosthetic knee implant system of claim 2 or claim 3 wherein:

the mounting platform of the femoral component lies in a plane... ...of the superior side and at least part of the inferior side lying in separate non-parallel planes, the stem collar further having a bore extending from the superior side to the inferior side, the bore having a central longitudinal axis defining an obtuse angle with at least one of the plane of the superior side and the plane of the inferior side.

5. The prosthetic knee implant system of claim 4 wherein:

the stem collar and femoral augment are capable of being... ...femoral component with the inferior side of the augment against the mounting platform.

6. The prosthetic knee implant system of any of claims 2-5 wherein the stem collar, augment and mounting

platform include mating anti-rotation members.

7. The prosthetic knee implant system of claim 6 wherein the anti-rotation members comprise:

opposing tabs on the mounting... ...stem collar; and

opposing anti-rotation surfaces and upstanding tabs on the augment.

8. The prosthetic knee implant system of claim 7 wherein the distance between the opposing anti-rotation surfaces on the... ...same as the distance between the opposing anti-rotation surfaces on the augment.

9. The prosthetic knee implant system of claim 7 or claim 8 wherein the distance between the opposing tabs on...

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**Lee et al.**

(10) **Patent No.: US 6,869,447 B2**
(45) **Date of Patent: Mar. 22, 2005**

(54) **PROSTHETIC KNEE IMPLANT WITH MODULAR AUGMENT**

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(73) Assignee: **Depuy Products, Inc.**, Warsaw, IN (US)

( * ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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(52) **U.S. Cl.** ..... **623/20.15**; 623/20.28; 623/20.31
(58) **Field of Search** ..... 623/20.14, 20.15, 623/20.17, 20.28, 20.29, 20.31

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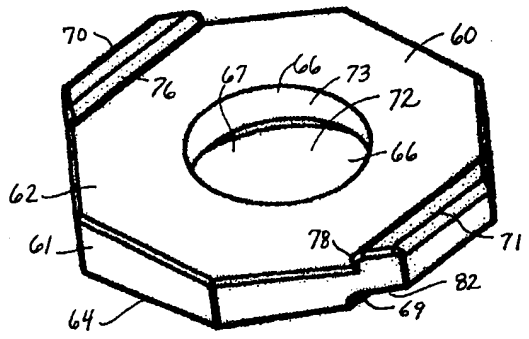
*Primary Examiner*—Corrine McDermott
*Assistant Examiner*—Suzette J. Jackson

(57) **ABSTRACT**

A modular prosthetic knee implant system includes a femoral component, a femoral stem, a femoral stem collar, an augment and a bolt. The modular prosthetic knee system can be assembled in different ways. If assembled without the augment, the stem is at a valgus angle. If assembled with the augment, the stem is at a neutral angle. The stem collar has an inferior surface that is angled with respect to its superior surface, and the augment has a superior surface that is angled with respect to its inferior surface. The components also include mating anti-rotation members to fix the relative positions of the members.

**18 Claims, 8 Drawing Sheets**



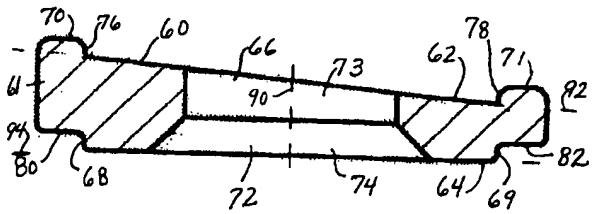



FIG 4

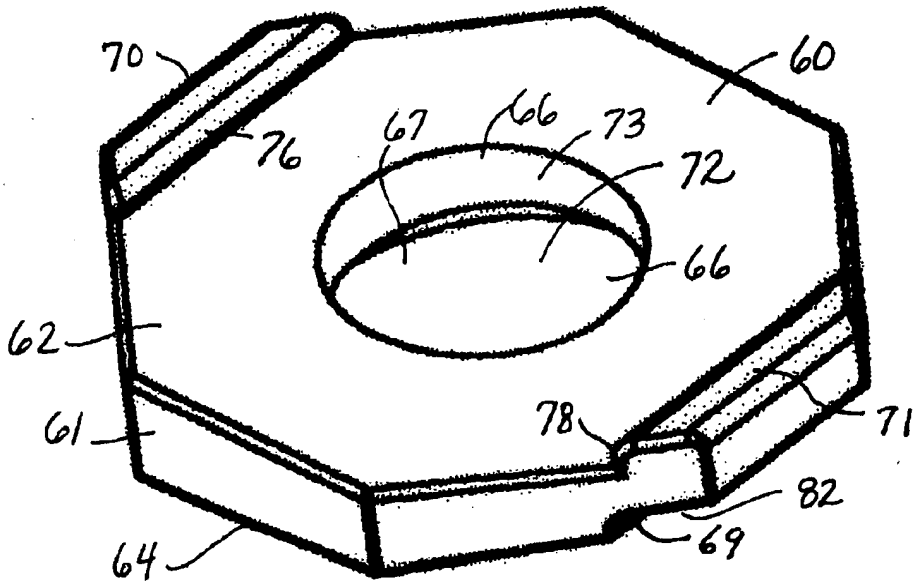

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FIG. 5

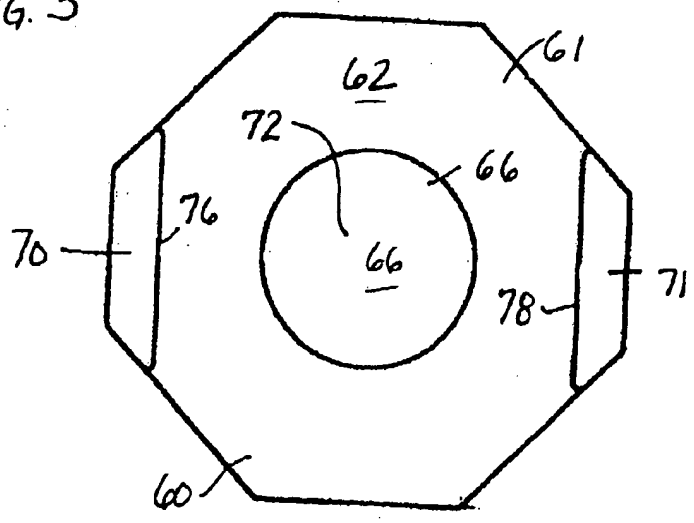
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FIG. 6

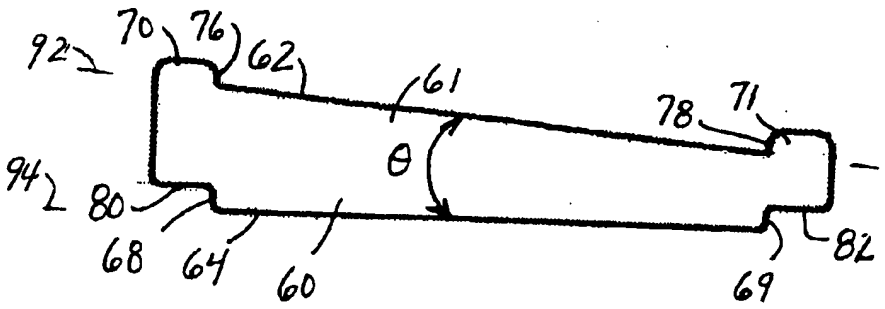
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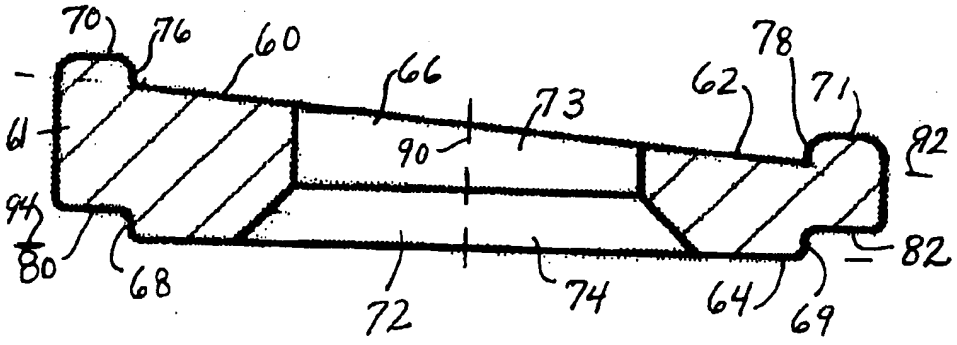
FIG. 7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The femoral component has a pair of condylar portions and an intercondylar portion. The intercondylar portion has a mounting platform; at least part of the mounting platform lies in a plane. The stem collar has a superior side and an inferior side; at least part of the superior side and at least part of the inferior side lie in separate non-parallel planes. The stem collar also has a bore extending from the superior side to the inferior side; the bore has a central longitudinal axis that defines an obtuse angle with at least one of the plane of the superior side and the plane of the inferior side of the stem collar. The augment has a superior side and an inferior side; at least part the superior side and at least part of the inferior side of the augment lie in separate non-parallel planes. The augment also has a bore extending from the superior side to the inferior side; the bore has a central longitudinal axis that defines an obtuse angle with at least one of the plane of the superior side and the plane of the inferior side. The stem collar, augment and mounting platform of the femoral component further include mating anti-rotation members.

In another aspect, the present invention provides a modular augment for use with a prosthetic knee implant. The modular augment has a body with a superior side and an inferior side. At least a portion of the superior side of the augment lies in a superior plane. At least a portion of the inferior side of the augment lies in an inferior plane. A bore extends from the superior side to the inferior side of the augment. The bore has a central longitudinal axis that defines an obtuse angle with at least one of the superior plane and inferior plane.

In another aspect, the present invention provides a prosthetic knee implant comprising a femoral component, an augment, a stem collar, a stem and a bolt. The femoral component includes a pair of condylar portions and an intercondylar portion having a mounting platform with an opening. The augment has an inferior side on the mounting platform of the femoral component and a superior side; the augment also has a bore extending from the superior side to the inferior side. The stem collar has an inferior side on the superior side of the augment and a superior side; the stem collar also has a bore extending from the superior side to the inferior side and aligned with the bore of the augment. The stem member extends outward from the superior side of the stem collar. The bolt extends through the opening in the mounting platform of the intercondylar portion of the femoral component, through the bore of the augment and the bore of the stem collar to the stem member.

## BRIEF DESCRIPTION OF THE DRAWINGS

A prior art modular femoral implant and a modular femoral implant incorporating the principles of the present invention are illustrated in the accompanying drawings, where like reference numbers are used for like parts and wherein:

FIG. **1** is an elevation of a prior art modular femoral implant, shown assembled and from the lateral side;

FIG. **2** is an elevation of the prior art modular femoral implant of FIG. **1**, shown assembled and from the posterior side;

FIG. **3** is an exploded view of the prior art modular femoral implant of FIGS. **1–2**;

FIG. **4** is a perspective view of a femoral stem augment incorporating the principles of the present invention;

FIG. **5** is a top plan view of the femoral stem augment of FIG. **4**;

FIG. **6** is a side elevation of the femoral stem augment of FIGS. **4–5**;

FIG. **7** is a cross-section of the femoral stem augment of FIGS. **4–6**, taken along line **7—7** of FIG. **5**;

FIG. **8** is an exploded view of a femoral implant assembly combining the femoral stem augment of FIGS. **4–7** with the prior art femoral implant components of FIGS. **1–3**;

FIG. **9** is an elevation of the femoral implant assembly combining the femoral stem augment of FIGS. **4–7** with the prior art femoral implant components of FIGS. **1–3**, shown from the posterior side;

FIG. **10** shows the femoral implant assembly of FIG. **9** from the lateral side;

FIG. **11** is a perspective view of the femoral implant assembly of FIGS. **8–10**;

FIG. **12** is an enlarged perspective view of the femoral implant assembly of FIG. **11**, showing the connection of the components;

FIG. **13** is an enlarged side elevation of a portion of an assembly of a femoral component, femoral stem, femoral stem collar and augment; and

FIG. **14** is a cross-section of the assembly of FIG. **13**.

## DETAILED DESCRIPTION OF THE INVENTION

A femoral stem augment incorporating the principles of the present invention is illustrated in FIGS. **4–12** at **60**. The femoral stem augment **60** of the present invention may be used with commercially available prosthetic knee components, as shown in FIGS. **8–12**, where the same reference numbers for prior art components and features of components are used as were used above in describing the prior art illustrated in FIGS. **1–3**.

As shown in FIGS. **4–7**, the femoral stem augment **60** comprises a body **61** having a superior side **62** and an inferior side **64**. As shown in FIGS. **6–7**, the superior side **62** of the augment **60** lies in a superior plane and the inferior side **64** lies in a non-parallel inferior plane. The femoral stem augment has a central opening **66** in the superior side **62**, an enlarged-diameter opening **67** in the inferior side **64**, a pair of inferior anti-rotation flats **68, 69** and a pair of superior anti-rotation tabs **70, 71**.

As shown in FIGS. **4–5**, the illustrated femoral stem augment **60** has an overall octagonal shape, in plan view, as illustrated in FIGS. **4–5**. However, it should be understood that this shape is provided for purposes of illustration only. The present invention is not limited to any particular shape of femoral stem augment **60** unless expressly called for in the claims.

In elevation, the illustrated femoral stem augment **60** has a wedge shape, as shown in FIGS. **6–7**. As there shown, the superior surface **62** of the augment **60** defines an angle θ with the inferior surface **64**. The angle θ corresponds with one of the valgus angles provided by the femoral stem collars **18**. For example, if an implant kit includes femoral stems and collars **18** defining angles of 5° and 7°, then the stem augment **60** should be provided to define a counter angle of either 5° and 7°. Although a kit could include stem augments **60** of both angles, only one set of augments with one angle should be necessary since the kit would generally include a complete set of stem members in both the 5° and 7° sizes.

In the illustrated embodiment, a bore or channel **72** extends between the apertures or openings **66, 67** of the femoral stem augment. The bore or channel **72** has a superior cylindrical portion **73** and an inferior frusto-conical portion **74**. The illustrated frusto-conical portion **74** defines a coun-

60/3K/52 (Item 52 from file: 348) **Links**
EUROPEAN PATENTS

01107269

# APPARATUS FOR SPINAL FUSION USING IMPLANTED DEVICES

VORRICHTUNG ZUR SPONDYLODESE MIT IMPLANTIERTEN TEILEN
APPAREIL D'ARTHRODESE DU RACHIS UTILISANT DES DISPOSITIFS IMPLANTES
VORRICHTUNG ZUR SPONDYLODESE MIT IMPLANTIERTEN TEILEN
APPAREIL D'ARTHRODESE DU RACHIS UTILISANT DES DISPOSITIFS IMPLANTES

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| | Country | Number | Kind | Date | |
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| Patent | EP | 1076536 | A1 | 20010221 | (Basic) |
| | EP | 1076536 | B1 | 20051109 | |
| | WO | 1999056676 | | 19991111 | |
| Application | EP | 99920362 | | 19990506 | |
| | WO | 99US9841 | | 19990506 | |
| Priorities | US | 72777 | | 19980506 | |
| | US | 248151 | | 19990210 | |

Designated States:
AT; BE; CH; CY; DE; DK; ES; FI; FR; GB;
GR; IE; IT; LI; LU; MC; NL; PT; SE;

International Patent Class (V7): A61F-002/44; A61F-002/46; A61B-017/16; A61B-017/17;
A61F-002/44... ...A61F-002/46

NOTE: No A-document published by EPO

| Type | Pub. Date | Kind | Text |
|---|---|---|---|

Publication: English
Procedural: English
Application: English

| Available Text | Language | Update | Word Count |
|---|---|---|---|
| CLAIMS B | (English) | 200545 | 1319 |
| CLAIMS B | (German) | 200545 | 1340 |
| CLAIMS B | (French) | 200545 | 1420 |
| SPEC B | (English) | 200545 | 7871 |
| Total Word Count (Document A) 0 | | | |
| Total Word Count (Document B) 11950 | | | |
| Total Word Count (All Documents) 11950 | | | |

Specification: ...loads. The device further comprises one or more holes through and/or cavities inside the implant such that the spaces created can be filled with bone graft material which will grow into and attach to the healthy vertebral bone. Optionally in all embodiments tapers to accommodate natural lumbar lordosis can be incorporated as necessary.

In this discussion, we use... ...material and new bony growth. As discussed at greater length below, in one embodiment, human bone allograft material is used to fabricate the implant. The new fusion bone will gradually share an increasing portion of the compressive loads experienced by the spine because the implant is made of a material, such as a polymer, which has a compressive modulus which works in conjunction with the implant design to closely match the modulus of elasticity of bone during deformation under load. The polymer, or in one embodiment human bone allograft material, has... ...being transparent in x-ray imaging permitting ,easy visualization of the fusion process at the vertebral interface. In a variant of one embodiment, metal retaining clips may be located in the implant surface, both above and below the dovetails, to engage the cortical bone and prevent the implant from migrating out of the intervertebral space. The retainers will generally be metal in order to benchmark x-ray imaging for... ...to assist in securing the implant to adjacent bony surfaces to minimize pullout.

In a second embodiment of the implant, a plurality of dovetail protrusions, or a compound dovetail protrusion in the approximate layout of a horseshoe may be located on the outboard portions of the implant, thereby utilizing the strength and rigidity of the vertebrae to support the spinal column load. In this case the device would contain a hollow central core which would... ...space.

In the first preferred embodiment, as shown in Figs. 1A and 1B (elevation views), vertebrae L4 and L5 (or vertebrae L5 and S1) are mechanically attached by the implant of this invention 3. The device 3 is held mechanically to the adjacent vertebrae 1 and 2 by tongue and groove, or dovetail, arrangements 4. As shown in Fig. 2 (plan view), the implant 3 is sited so as to provide mechanical support to the spine both in compression and in tension, but not so as to intrude into the space 6 occupied by the spinal nerve bundle. In this preferred embodiment, as shown in Fig.2, the implant 3 will include penetrations or holes 7 the purpose of which is to contain bone growth material to facilitate bony fusion of the adjacent vertebrae. The implant itself may comprise a variety of presently acceptable biocompatible materials such as Polyphenolsulfone, Polyaryletherketone (PEEK... ...REM glass filaments to add tensile and shear strength. As discussed more extensively below, the implant may also be fabricated from human bone allograft material, autograft material, or bone substitute material, such as

coral or calcium phosphate. The body of the implant may optionally have a modest taper to accommodate the natural lordosis of the lumbar spine.

One possible problem with an implant with dovetail fasteners fabricated from a material such as polysulfone is that torque on one adjacent vertebra relative to the other may place large tension stresses on the angular portions of the dovetail, thereby causing breaking and crazing of the polysulfone. Thus a variation on this embodiment comprises... ...from plastic material such as polysulfone for the body and titanium for endplates bearing the dovetail protrusions.

Figures 3A, 3B, and 3C show one possible arrangement of such a composite structure... ...this arrangement with the endplate extending to the shoulders of the plastic body of the implant 11. Both Figs. 3 and 4 show a variation of this structure, with the titanium endplate 12 set into the plastic body of the implant 9 and 11 in a configuration designed to provide through spaces or cavities 14 in which to place bone growth material. In these latter configurations, the polysulfone body is insert molded into the titanium endplates. The titanium dovetail fasteners possess the tensile strength necessary to avoid fracture or crazing, but the body is... ...two vertebrae, e.g., L4 and L5 or L5 and S1 and mechanically attached by two or more dovetail joints, or by a compound horseshoe shaped dovetail, located on each of the top and bottom surfaces of the implant to the adjacent remaining vertebrae by a composite tongue and groove mechanism similar to but larger than that used to secure the implant of the previous embodiment. In this configuration, the implant comprises either a horseshoe shaped dovetail tongue 33 which in effect creates two dovetail joints per surface toward the outboard ends of the implant top and bottom surfaces or simply two outboard dovetail tongues without the horseshoe top closure. The horseshoe top closure may be substantially curved or it may be substantially straight, with relatively square corners where the dovetail tongue angles back into the body of the vertebra. In a variation on this embodiment, inside the horseshoe shaped dovetail tongue protrusion 33 the body of the implant is hollow, that is, it contains an opening or cavity 34 communicating with both the top surface and the bottom surface into which bone growth material is placed.

In this preferred embodiment, as further shown in the isometric view of Fig. 6, the implant 35 with a relatively squared off horseshoe top closure will have a surface approximately flush with the exterior surface of the adjacent vertebrae and will appear to create one very wide dovetail 37. This embodiment of the implant will also include penetrations or holes in addition to or as an alternative to that shown in Fig. 5, 34, the purpose of which is also to contain bone growth material to facilitate bony fusion of the adjacent vertebrae. As in the prior configuration, the implant 35 is sited so as to provide mechanical support both in compression and in tension to the spinal column, but not so as to intrude into the space 6 occupied by the spinal nerve bundle. The implant in some cases is further inserted inside remaining segments of intervertebral disc tissue 38. As shown in both Figs. 5 and 6, an optional feature of these embodiments is for the faces of the implant to have locking barbs 36 to retain the implant in place between the remaining vertebrae once it is inserted.

This implant, as in the prior embodiment, may itself comprise a variety of presently acceptable implant materials such as PEEK (Polyesther Esther Ketone), Acetyl (delrin), polysulfone, Ultra High Molecular Weight Polyethylene... ...be used to fabricate this device. This embodiment may also be fabricated with a modest taper to accommodate natural lordosis.

A third preferred embodiment of the lumbar implant, shown in isometric view in Figure 7, comprises three elements, two modular dovetail halves, 41 and 42, which are inserted between vertebrae L4 and L5 or L5 and S1 and mechanically attached by two dovetail protrusions (similar to those fabricated for the second embodiment) located on the top and bottom of the implant to the adjacent vertebrae by a tongue and groove mechanism similar to but larger than that used to secure previous embodiments of the implant. The two modular dovetail

halves are held together by a retainer 43. As in the prior configuration, as shown in the isometric view of Fig.8, the implant 35 is sited so as to provide mechanical support both in compression and in tension to the spinal column, but not so as to intrude into the space 8 occupied by the spinal nerve bundle.

In this preferred embodiment, as shown in Fig.8, the implant 35 will include a cavity 39 the purpose of which is to contain bone growth material to facilitate bony fusion of the adjacent vertebrae. The open space 39 is packed with bone growth material and then capped with a retainer, 43, designed to snap in place to add stability to the implant and to retain the bone growth factor to prevent it from migrating. This implant, as in the prior embodiment, may itself comprise a variety of presently acceptable implant materials... ...strength carbon fibers or glass filaments to add tensile and shear strength. Again the modular dovetail halves may be tapered to accommodate lordosis.

Any of the foregoing embodiments can additionally have a feature shown in... ...retractable barb 36. This barb comprises a spring wire which when deployed engages the adjacent vertebrae to prevent the implant from dislodging. A retraction tool may be inserted into the hole 39 to cause the sigma-shaped barb to retract its probe-like end so that the implant disengages from the adjacent vertebra.

As previously noted, any of the foregoing embodiments of the Cor-Lok(TM) interlocking implant can be fabricated from cadaver bone which is processed to form bone allograft material. Tissue grafting of living tissue from the same patient, including bone grafting, is... ...is the exact size and shape needed for the host site where it will be implanted, but it has proved very difficult to achieve this goal.

On the other hand, processing of bone material which does not contain living tissue is becoming more and more important. Non-living... ...sources of safely processed allograft material have recently become available.

In the present invention, allograft bone is reshaped into one of the Cor-Lok(TM) configurations for use as a spine implant. Various methods, including that of Bonutti, U.S. Patents Nos. 5,662,710 and 5... ...Gunderson, H. J. G., et al., "Biologically meaningful determinants of the in vitro strength of lumbar vertebrae," Bone 1991;12:219-24. Compressing bone

allograft material prior to implantation thus generally produces a stronger graft.

Compression also allows conversion of larger irregular shapes into... ...a precisely matching cut space. In particular, this method of formation facilitates the formation of dovetail tongue protrusions on the upper and lower surfaces of the implant for the formation of a tongue-and-groove mechanical joint with adjacent vertebrae.

In the current invention, a blank is cut from cancellous or trabecular allograft bone and... ...forming apparatus compresses the sample into the desired shape. In particular, this process forms the dovetail tongue protrusions on the implant upper and lower surfaces for the tongue -and-groove joint. The cancellous or trabecular material yields at the external surface under the pressure to... ...the allograft material to perform the same function in resisting torsion and extension of the spine as does the synthetic materials previously discussed. Such processes in general are able to maintain the homologous property of... ...to provide needed additional structural properties, such as tensile strength to a composite shape. Cortical bone can also be provided in a shell, much like the known femoral ring implants, to provide the needed structural properties. Moreover, a shell is not the only structural element... ...can be included in the same way. Using such materials, the homologous property of the bone allograft material may be maintained.

In another sub-embodiment, a relatively thin external shell of a synthetic material can be provided for enclosing compressed allograft material and providing any needed additional structual... ...of a material which expands after it

is placed in the spine, thereby supplementing the interlocking properties of the Cor-Lok(TM) mechanical design by improving the fill between the allograft... ...or polymeric materials.

Figures 10A through 16B depict the surgical tools used to install the implant. This apparatus comprises a set of unique tools which will accurately cut a dovetail joint in bone for the purpose of inserting an implant which locks adjacent vertebrae together.

The guide 44, shown in Figs. 10A and 10B, is a tubular tool with tangs 45 extending from one end. The tangs, tapered 46 to conform to natural lordosis, are inserted between the vertebrae 47 and distract them... ...the guide 44 to make an end-cut 52, shown in Fig. 11B, for the dovetail. Once completely inserted to the depth stop 53, a single piece interlock 54, shown in Figs. 12A and 12B, which prevented rotation of the blade 55 during... ...cut tool 52 from the guide 44. As shown in Figs. 12A and 12B, the interlock 54 is held by spring 57 such that it engages the slot 58 in the... ...As the end cut tool 52 is inserted into the guide 44 it pushes the interlock 54, rotating it out of the slot 58 in the shaft 56 as shown in Fig. 12B. As the interlock rotates, it engages the guide 44 as shown in Fig. 12B. When the shaft 56 is rotated as shown in Fig. 12B the interlock 54 cannot return to its original position as shown in Fig. 12A, thus securing the end cut tool 52 in the guide 44. The rotation interlock protects the surgeon from the end cut blade 55 and the withdrawal interlock holds the end cut tool 52 in the guide 44 while the blade 55 is... ...at which the end cut tool 52 can be removed from the guide 44.

The dovetail tome 60, shown in Fig. 13A, is inserted into the guide 44 to the point where the blade 61 rests against the vertebrae 47. As shown in Fig. 15, the driver 68 is placed on the dovetail tome rod extension 62 and drives the dovetail tome 60, cutting the vertebrae 47, until the depth stop 63 of the dovetail tome contacts the stop 51 on the guide 44, stopping the blade 61 at the end-cut 52, as shown in Fig. 13C. The dovetail tome blade 61, as shown in Fig. 14A, has endplate breakers 64 which split the... ...14B, preventing them from jamming in the blade and preparing them for later use. The dovetail tome 60 is removed and the bone 67 and the split vertebral end plate 66 contained in the blade 61 is harvested for later use in the implant 33.

As shown in Fig. 15, the driver 68 is a pneumatic tool like a... ...68 receives the rod extension from the guide adapter 70 or the rod extension of dovetail tome 62 into a guide port 71. A piston 72, within the driver 68, repeatedly impacts the guide adapter 70 or the dovetail tome rod extension 62, driving the tool into place. The driver 68 is activated by... ...several thousand small impacts in place of a few massive blows from a hammer.

The implant 33 of Fig. 5 is prepared for insertion by filling the interior portion 34 with harvested bone 67 and the split end plates 66 from the dovetail tome cuts and additional bone and graft stock. The implant 33 is then slid down the guide 44 (Fig. 10) and driven into place by... ...contacts the depth stop 51 of the guide 44 and assures correct placement of the implant 33, locking the vertebrae 47.

The above implant devices contain attachment means which are well known in the woodworking industry, but are not used in Orthopedic Spine Surgery. However, one skilled in the art of intervertebral implants would readily be able to adapt other fastening devices known in the woodworking art to spinal implant devices. It should be readily apparent to anyone skilled in the art that there are several available means to attach bone surfaces to the adjacent implant surfaces, such as causing bone anchors to protrude from the implant surface and impinge and attach the adjacent vertebrae to the implant. Metal staple-like clips can be driven between adjacent vertebrae to attach the edges of the vertebrae. Tack and staple configurations can substitute for the dovetail tongue and groove fasteners. Bone anchors can also be used to attach natural tissue to adjacent vertebrae, creating an artificial ligament which could scar down, thus retaining an artificial implant within the disc space while

osteoinduction takes place and the vertebrae fuse.

US006096080A

# United States Patent [19]

Nicholson et al.

[11] Patent Number: 6,096,080

[45] Date of Patent: Aug. 1, 2000

[54] APPARATUS FOR SPINAL FUSION USING IMPLANTED DEVICES

[75] Inventors: James E. Nicholson, Lincoln; Scott G. Tromanhauser, Marblehead; Dale E. Whipple, Taunton, all of Mass.

[73] Assignee: Cortek, Inc., Dedham, Mass.

[21] Appl. No.: 09/248,151

[22] Filed: Feb. 10, 1999

Related U.S. Application Data

[63] Continuation-in-part of application No. 09/072,777, May 6, 1998.

[51] Int. Cl.[7] ..... A61F 2/44

[52] U.S. Cl. ..... 623/17; 623/16

[58] Field of Search ..... 623/17, 16; 606/61

[56] References Cited

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| 5,865,847 | 2/1999 | Kohrs et al. | 623/17 |
| 5,865,848 | 2/1999 | Baker | 623/17 |
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| 98/42269 | 10/1998 | WIPO . | |
| WO 98/55052 | 12/1998 | WIPO | A61F 2/44 |
| 99/04733 | 2/1999 | WIPO . | |

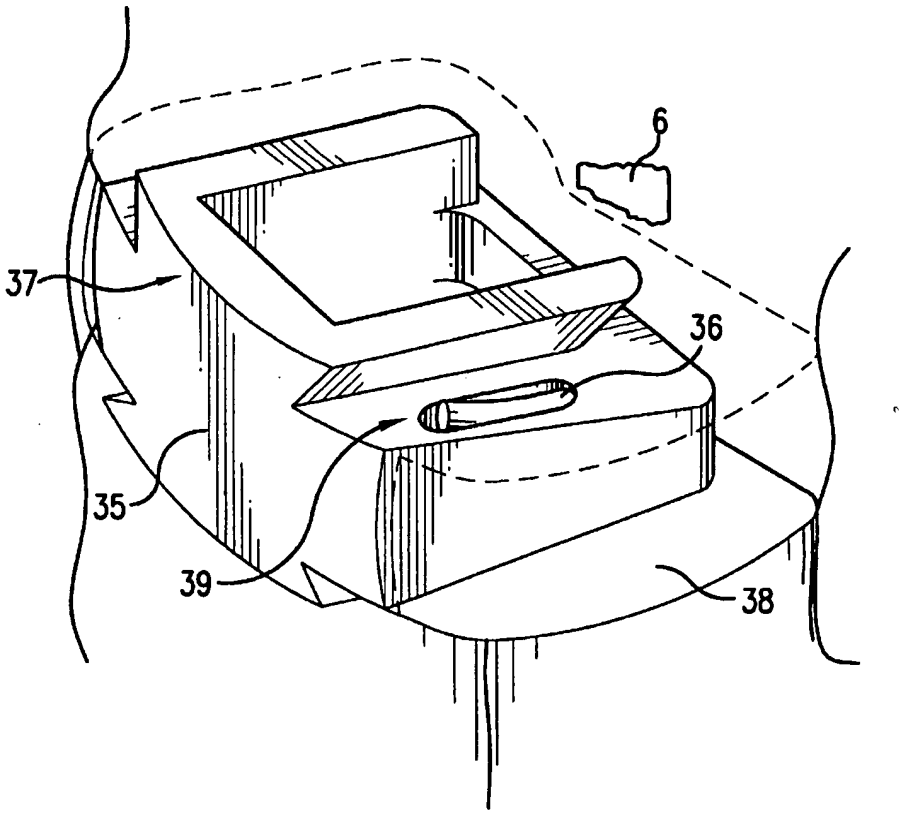
*Primary Examiner*—Jeffrey A. Smith

*Attorney, Agent, or Firm*—Frederick C. Williams

[57] ABSTRACT

A spinal implant replaces excised tissue removed during spine surgery. This implant includes fasteners which firmly attach it to vertebrae adjacent to excised tissue so as to transmit tension and torsional loads to and from those vertebrae. The body of the implant has through cavities into which bone growth material is placed during surgery. The body of the implant also has a finite modulus of elasticity in compression so as to share compressive loads with emplaced bone growth material and with new bony growth facilitated by the emplaced material and the load sharing.

**22 Claims, 11 Drawing Sheets**



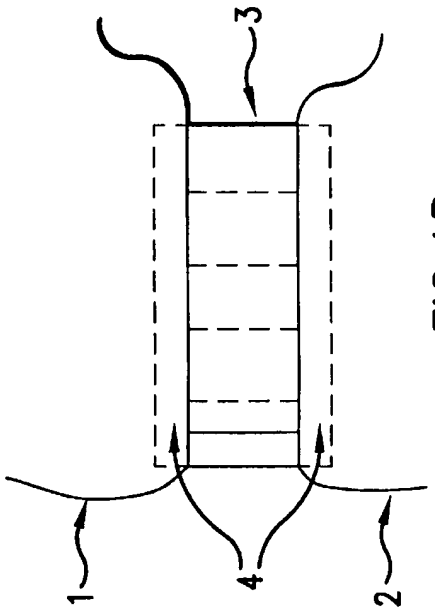



FIG.1B

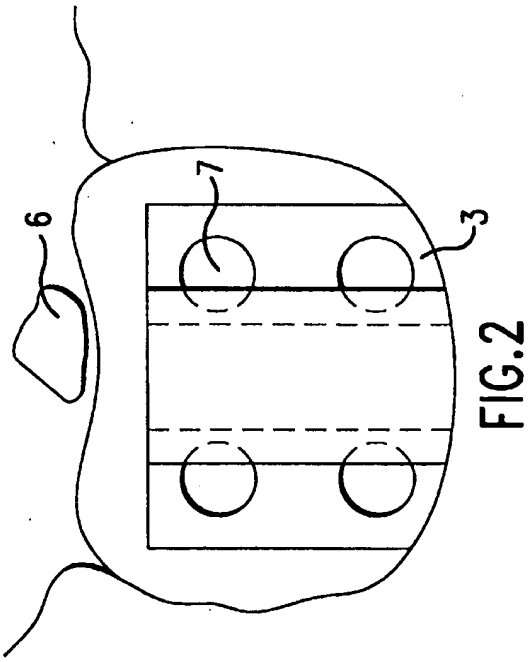



FIG.2

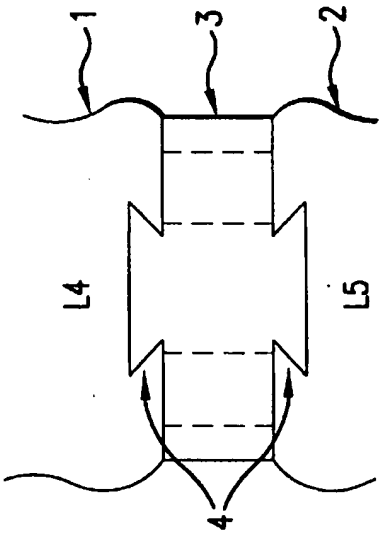



FIG.1A

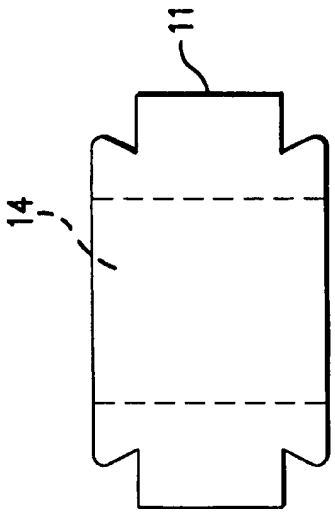



FIG.4B

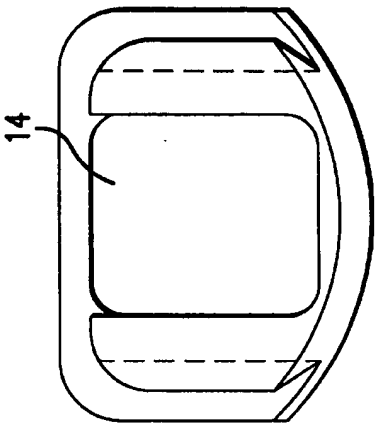



FIG.4A

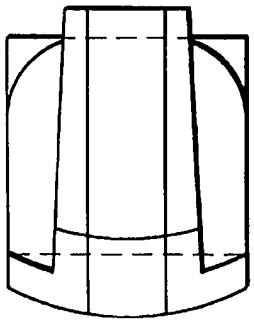


FIG.4C

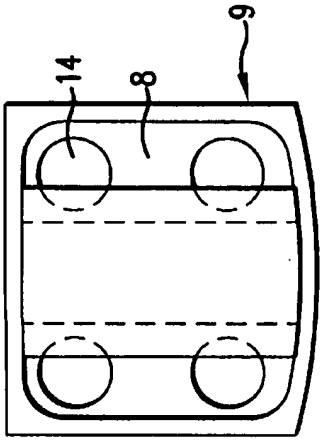



FIG.3A

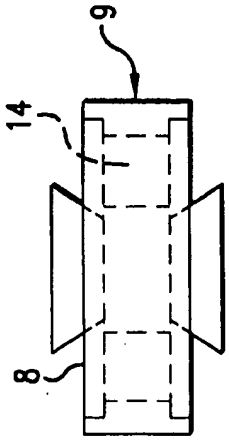



FIG.3B

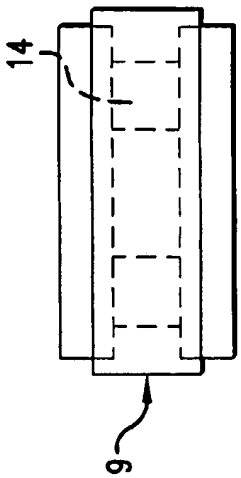



FIG.3C

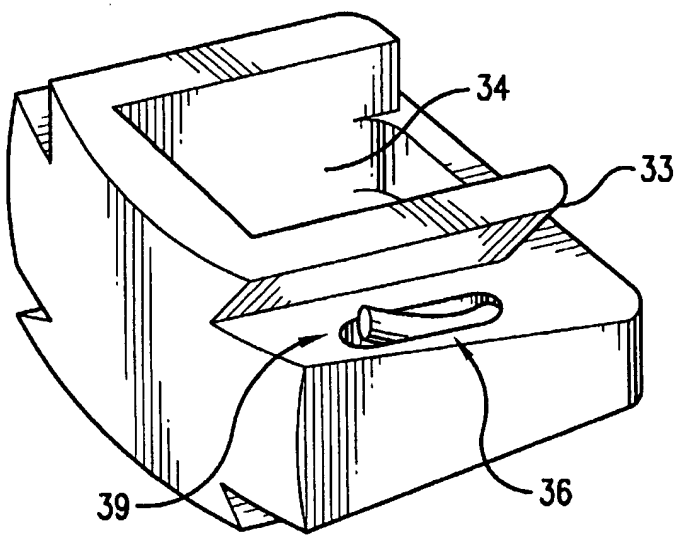



FIG.5

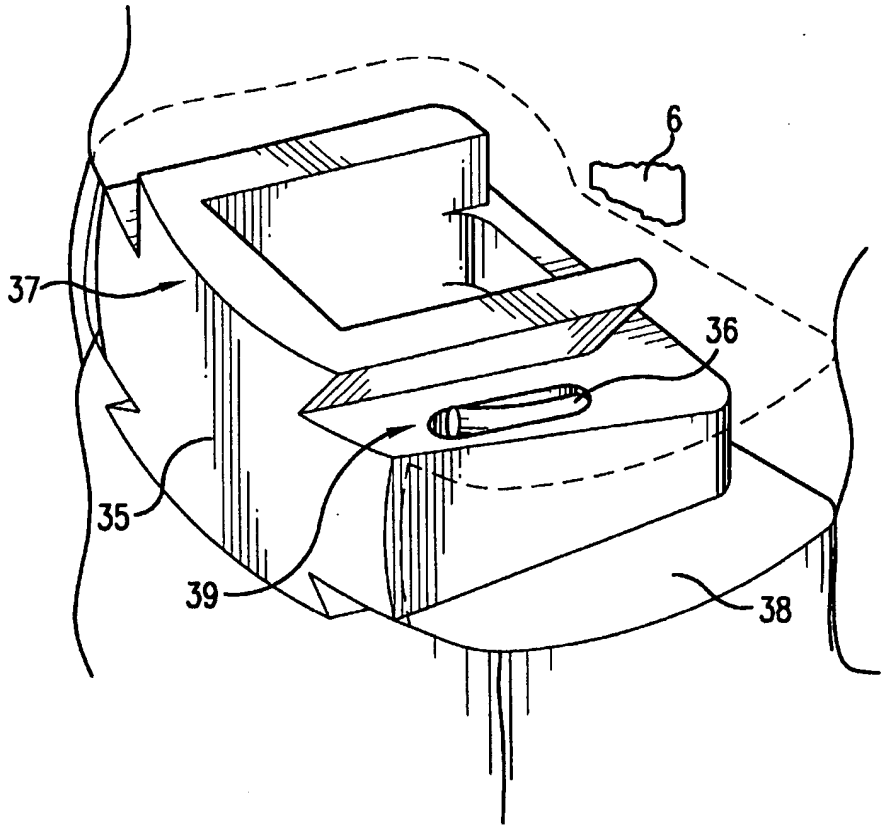



FIG.6

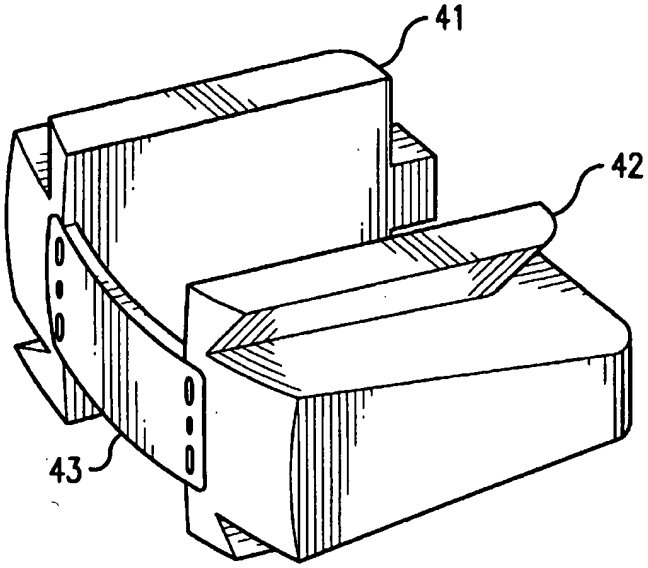



FIG.7

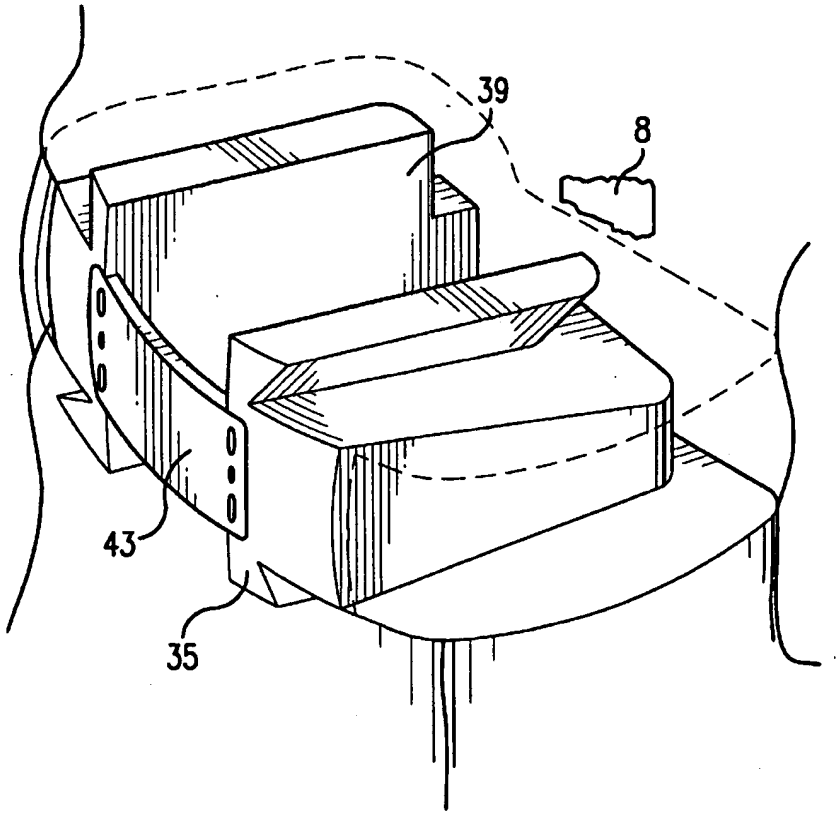



FIG.8

34/5K/1 (Item 1 from file: 348) **Links**
EUROPEAN PATENTS

02186256
Intervertebral prosthesis with self-cutting fixation protrusions
Zwischenwirbelprothese mit selbstschneidenden Fixiervorsprungen
Prothese intervertebrale avec saillies de fixation auto-penetrantes
Intervertebral prosthesis with self-cutting fixation protrusions

Patent Assignee:

- Cervitech, Inc.; (4400510)
  300 Roundhill Drive; Rockaway, NJ 07866; (US)
  (Applicant designated States: all)

Inventor:

- Keller, Arnold
  An der Naherfurth 5; 23863 Kayhude; (DE)
- Keller, Arnold
  ; ;

Legal Representative:

- Glawe, Delfs, Moll (100693)
  Patent- und Rechtsanwalte, Rothenbaumchaussee 58; 20148 Hamburg; (DE)

| | Country | Number | Kind | Date | |
|---|---|---|---|---|---|
| Patent | EP | 1736120 | A1 | 20061227 | (Basic) |
| Application | EP | 2005013517 | | 20050622 | |

Designated States:
AT; BE; BG; CH; CY; CZ; DE; DK; EE; ES;
FI; FR; GB; GR; HU; IE; IS; IT; LI; LT;
LU; MC; NL; PL; PT; RO; SE; SI; SK; TR;

34/5K/2 (Item 2 from file: 348) **Links**
EUROPEAN PATENTS

02082420
Cervical intervertebral prostheses
Zervikale Zwischenwirbelprothesen
Protheses intervertebrales cervicales
Cervical intervertebral prostheses

Patent Assignee:

- Cervitech, Inc.; (4400510)
  300 Roundhill Drive; Rockaway, NJ 07866; (US)
  (Applicant designated States: all)

Inventor:

- Keller, Arnold
  An der Naherfurth 5; 23863 Kayhude; (DE)
- Keller, Arnold
  ; ;

Legal Representative:

- Glawe, Delfs, Moll (100693)
  Patent- und Rechtsanwalte, Rothenbaumchaussee 58; 20148 Hamburg; (DE)



| | Country | Number | Kind | Date | |
|---|---|---|---|---|---|
| Patent | EP | 1685811 | A1 | 20060802 | (Basic) |
| Application | EP | 2005001557 | | 20050126 | |

Designated States:
AT; BE; BG; CH; CY; CZ; DE; DK; EE; ES;
FI; FR; GB; GR; HU; IE; IS; IT; LI; LT;
LU; MC; NL; PL; PT; RO; SE; SI; SK; TR;

34/5K/3 (Item 3 from file: 348) **Links**
EUROPEAN PATENTS

02072161
Pair of intervertebral implants
Paar von Zwischenwirbelprothesen
Une paire de implants intervertebraux
Pair of intervertebral implants
Une paire de implants intervertebraux

Patent Assignee:

- Cervitech, Inc.; (4400510)
  300 Roundhill Drive; Rockaway, NJ 07866; (US)
  (Applicant designated States: all)

Inventor:

- Keller, Arnold
  An der Naherfurth 5; 23863 Kayhude; (DE)
- Keller, Arnold
  ; ;

Legal Representative:

- Glawe, Delfs, Moll (100693)
  Patent- und Rechtsanwalte, Rothenbaumchaussee 58; 20148 Hamburg; (DE)

| | Country | Number | Kind | Date | |
|---|---|---|---|---|---|
| Patent | EP | 1681039 | A1 | 20060719 | (Basic) |
| Application | EP | 2005000841 | | 20050117 | |

34/5K/4 (Item 4 from file: 348) **Links**
EUROPEAN PATENTS

01761000
Hip prosthesis with a stem to be implanted into the medullary canal of the femur
Huftprothese mit einem in den Markkanal des Oberschenkelknochens zu verankernden Schaft
Prothese de hanche avec un tige pour etre implante dans le canal medullaire du femur
Hip prosthesis with a stem to be implanted into the medullary canal of the femur
Prothese de hanche avec un tige pour etre implante dans le canal medullaire du femur

Patent Assignee:

- WALDEMAR LINK GmbH & Co. KG; (297143)
  Barkhausenweg 10; 22339 Hamburg; (DE)
  (Proprietor designated states: all)

Inventor:

- Keller, Arnold
  An der Naherfurth 5; 23863 Kayhude; (DE)
- Keller, Arnold
  ; ;

Legal Representative:

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  Patentanwalte Rothenbaumchaussee 58; 20148 Hamburg; (DE)

| | Country | Number | Kind | Date | |
|---|---|---|---|---|---|
| Patent | EP | 1438933 | A1 | 20040721 | (Basic) |
| | EP | 1438933 | B1 | 20050406 | |
| Application | EP | 2003016156 | | 20030716 | |
| Priorities | EP | 20031040 | | 20030117 | |

Designated States:

34/5K/5 (Item 5 from file: 348) **Links**
EUROPEAN PATENTS

01760974
Hip prosthesis with stem for implantation into the femur
Huftprothese mit einem in den Oberschenkelknochen einzusetzenden Schaft
Prothese de la hanche avec tige pour l'implantation dans le femur
Hip prosthesis with stem for implantation into the femur
Prothese de la hanche avec tige pour l'implantation dans le femur

Patent Assignee:

- WALDEMAR LINK GmbH & Co. KG; (297143)
  Barkhausenweg 10; 22339 Hamburg; (DE)
  (Applicant designated States: all)

Inventor:

- Keller, Arnold
  An der Naherfurth 5; 23863 Kayhude; (DE)
- Keller, Arnold
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Legal Representative:

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  Patentanwalte Rothenbaumchaussee 58; 20148 Hamburg; (DE)

| | Country | Number | Kind | Date | |
|---|---|---|---|---|---|
| Patent | EP | 1438932 | A1 | 20040721 | (Basic) |
| Application | EP | 2003001041 | | 20030117 | |

Designated States:

34/5K/6 (Item 6 from file: 348) **Links**
EUROPEAN PATENTS

01687995
Knee prothesis
Knieprothese
Prothese du genou

Patent Assignee:

- WALDEMAR LINK GmbH & Co. KG; (297143)
  Barkhausenweg 10; 22339 Hamburg; (DE)
  (Applicant designated States: all)

Inventor:

- Keller, Arnold
  An der Naherfurth 5; 23863 Kayhude; (DE)
- Keller, Arnold
  ; ;

Legal Representative:

- Glawe, Delfs, Moll & Partner (100691)
  Patentanwalte Rothenbaumchaussee 58; 20148 Hamburg; (DE)

| | Country | Number | Kind | Date | |
|---|---|---|---|---|---|
| Patent | EP | 1384454 | A1 | 20040128 | (Basic) |
| Application | EP | 2002016768 | | 20020726 | |

Designated States:

34/5K/7 (Item 7 from file: 348) **Links**
EUROPEAN PATENTS

01630067
Intervertebral prosthesis especially for the cervical spine
Zwischenwirbelprothese, insbesondere fur die Halswirbelsaule
Prothese intervertebrale en particulier pour la colonne cervicale
Intervertebral prosthesis especially for the cervical spine

Patent Assignee:

- Waldemar Link (GmbH & Co.); (297141)
  Barkhausenweg 10; 22339 Hamburg; (DE)
  (Applicant designated States: all)

Inventor:

- Keller, Arnold
  An der Naherfurth 5; 23863 Kayhude; (DE)
- McAfee, Paul C., M.D. Scoliosis and Spine Center
  7505 Osler Drive, Suite 104; Baltimore , MD 21204; (US)
- Keller, Arnold
  ; ;

Legal Representative:

- Glawe, Delfs, Moll & Partner (100691)
  Patentanwalte Rothenbaumchaussee 58; 20148 Hamburg; (DE)

| | Country | Number | Kind | Date | |
|---|---|---|---|---|---|
| Patent | EP | 1344508 | A1 | 20030917 | (Basic) |
| Application | EP | 2002005632 | | 20020312 | |

Designated States:

34/5K/8 (Item 8 from file: 348) **Links**
EUROPEAN PATENTS

01630065
Intervertebral prosthesis for the cervical spine
Zwischenwirbelprothese fur die Halswirbelsaule
Prothese intervertebrale pour la colonne cervicale
Intervertebral prosthesis for the cervical spine

Patent Assignee:

- Waldemar Link (GmbH & Co.); (297141)
  Barkhausenweg 10; 22339 Hamburg; (DE)
  (Applicant designated States: all)

Inventor:

- Keller, Arnold
  An der Naherfurth 5; 23863 Kayhude; (DE)
- McAfee, Paul C.,M.D.c/o Scoliosis and Spine Center
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- Keller, Arnold
  ; ;

Legal Representative:

- Glawe, Delfs, Moll & Partner (100691)
  Patentanwalte Rothenbaumchaussee 58; 20148 Hamburg; (DE)

| | Country | Number | Kind | Date | |
|---|---|---|---|---|---|
| Patent | EP | 1344506 | A1 | 20030917 | (Basic) |
| Application | EP | 2002005630 | | 20020312 | |

Designated States:
AT; BE; CH; CY; DE; DK; ES; FI; FR; GB;

34/5K/9 (Item 9 from file: 348) **Links**
EUROPEAN PATENTS

01519208
Coupled knee prothesis with rotational bearing
Gekoppelte Knieprothese mit Rotationslager
Prothese du genou couple avec palier a rotation

Patent Assignee:

- Waldemar Link (GmbH & Co.); (297141)
  Barkhausenweg 10; 22339 Hamburg; (DE)
  (Applicant designated States: all)

Inventor:

- Keller, Arnold
  An der Naherfurth 5; 23863 Kayhude; (DE)
- Keller, Arnold
  ; ;

Legal Representative:

- Glawe, Delfs, Moll & Partner (100691)
  Patentanwalte Rothenbaumchaussee 58; 20148 Hamburg; (DE)

| | Country | Number | Kind | Date | |
|---|---|---|---|---|---|
| Patent | EP | 1269938 | A1 | 20030102 | (Basic) |
| Application | EP | 2001115511 | | 20010627 | |

34/5K/10 (Item 10 from file: 348) **Links**
EUROPEAN PATENTS

01476859
Knee prothesis with rotating bearing
Knieprothese mit Rotationslager
Prothese de genou avec palier de rotation

Patent Assignee:

- Waldemar Link (GmbH & Co.); (297141)
  Barkhausenweg 10; 22339 Hamburg; (DE)
  (Applicant designated States: all)

Inventor:

- Keller, Arnold
  An der Nahefurth 5; 23863 Kayhude; (DE)
- Keller, Arnold
  ; ;

Legal Representative:

- Glawe, Delfs, Moll & Partner (100691)
  Patentanwalte Rothenbaumchaussee 58; 20148 Hamburg; (DE)

| | Country | Number | Kind | Date | |
|---|---|---|---|---|---|
| Patent | EP | 1252869 | A1 | 20021030 | (Basic) |
| Application | EP | 2001110260 | | 20010425 | |

Designated States:

34/5K/11 (Item 11 from file: 348) **Links**
EUROPEAN PATENTS

01437958
Surgical instrument for implanting an intervertebral prosthesis
Chirurgisches Instrument zum Einsetzen einer Zwischenwirbelendoprothese
Instrument chirurgical pour implanter une prothese intervertebrale
Surgical instrument for implanting an intervertebral prosthesis
Instrument chirurgical pour implanter une prothese intervertebrale

Patent Assignee:

- Link Spine Group, Inc.; (4609371)
  7 South Main Street; Branford, CT 06405; (US)
  (Proprietor designated states: all)

Inventor:

- Keller, Arnold
  An der Naherfurth 5; 23863 Kayhude; (DE)
- Keller, Arnold
  ; ;

Legal Representative:

- Glawe, Delfs, Moll & Partner (100691)
  Patentanwalte Rothenbaumchaussee 58; 20148 Hamburg; (DE)

| | Country | Number | Kind | Date | |
|---|---|---|---|---|---|
| Patent | EP | 1222903 | A1 | 20020717 | (Basic) |
| | EP | 1222903 | B1 | 20050119 | |
| Application | EP | 2001125792 | | 20011029 | |
| Priorities | EP | 2001100754 | | 20010112 | |

Designated States:

34/5K/12 (Item 12 from file: 348) **Links**
EUROPEAN PATENTS

01220265
Intervertebral endoprosthesis with a toothed connection plate
Zwischenwirbel-Endoprothese mit einer gezahnten Anschlussplatte
Endoprothese intervertebrale avec une plaque de connexion dentee
Intervertebral endoprosthesis with a toothed connection plate

Patent Assignee:

- Waldemar Link (GmbH & Co.); (297141)
  Barkhausenweg 10; 22339 Hamburg; (DE)
  (Proprietor designated states: all)

Inventor:

- Keller, Arnold
  An der Naherfurth 5; 23863 Kayhude; (DE)
- Keller, Arnold
  ; ;

Legal Representative:

- Glawe, Delfs, Moll & Partner (100691)
  Patentanwalte Rothenbaumchaussee 58; 20148 Hamburg; (DE)

| | Country | Number | Kind | Date | |
|---|---|---|---|---|---|
| Patent | EP | 1057462 | A1 | 20001206 | (Basic) |
| | EP | 1057462 | B1 | 20030402 | |
| Application | EP | 99110053 | | 19990521 | |

Designated States:

34/5K/13 (Item 13 from file: 348) **Links**
EUROPEAN PATENTS

01184741
Prosthetic wrist joint
Handgelenkprothese
Prothese du poignet

Patent Assignee:

- Waldemar Link (GmbH & Co.); (297141)
  Barkhausenweg 10; 22339 Hamburg; (DE)
  (Proprietor designated states: all)
- Thabe, Heiner Dr. med.; (2674470)
  Wielandstrasse 26; 55543 Bad Kreuznach; (DE)
  (Proprietor designated states: all)

Inventor:

- Keller, Arnold
  An der Naherfurth 5; 23863 Kayhude; (DE)
- Thabe, Heiner Dr. med.
  Wielandstr. 26; 55543 Bad Kreuznach; (DE)
- Keller, Arnold
  ; ;

Legal Representative:

- Glawe, Delfs, Moll & Partner (100691)
  Patentanwalte Rothenbaumchaussee 58; 20148 Hamburg; (DE)

| | Country | Number | Kind | Date | |
|---|---|---|---|---|---|
| Patent | EP | 1031332 | A1 | 20000830 | (Basic) |
| | EP | 1031332 | B1 | 20031001 | |
| Application | EP | 99103377 | | 19990222 | |

Designated States:

34/5K/14 (Item 14 from file: 348) **Links**
EUROPEAN PATENTS

00903431
Device for implanting the femoral articular element of a knee endoprosthesis
Anordnung zum Einsetzen einer femoralen Knie-Gleitflachen-Endoprothese
Dispositif pour implanter l'element articulaire femoral d'une endoprothese du genou
Device for implanting the femoral articular element of a knee endoprosthesis

Patent Assignee:

- Waldemar Link (GmbH & Co.); (297141)
  Barkhausenweg 10; 22339 Hamburg; (DE)
  (applicant designated states: DE;ES;FR;GB;IT)

Inventor:

- Keller, Arnold
  An der Baherfurth 5; 23863 Kayhude; (DE)
- Keller, Arnold
  ; ;

Legal Representative:

- Glawe, Delfs, Moll & Partner (100698)
  Patentanwalte Liebherrstrasse 20; 80538 Munchen; (DE)

| | Country | Number | Kind | Date | |
|---|---|---|---|---|---|
| Patent | EP | 824904 | A2 | 19980225 | (Basic) |
| | EP | 824904 | A3 | 19981118 | |
| Application | EP | 97112565 | | 19970722 | |
| Priorities | DE | 29614349 | | 19960819 | |

Designated States:

34/5K/15 (Item 15 from file: 348) **Links**
EUROPEAN PATENTS

00883925
Saddle prosthesis
Sattelprothese
Prothese en forme de selle

Patent Assignee:

- WALDEMAR LINK GmbH & Co. KG; (297143)
  Barkhausenweg 10; 22339 Hamburg; (DE)
  (Proprietor designated states: all)

Inventor:

- Nieder, Elmar Dr.
  Hinterdeich 117; D-2155 Jork; (DE)
- Keller, Arnold
  An der Naherfurth 5; D-23863 Kayhude; (DE)
- ...DE)
  ; ;
- Keller, Arnold
  ; ;

Legal Representative:

- Glawe, Delfs, Moll (100697)
  Patentanwalte Postfach 13 03 91; 20103 Hamburg; (DE)

| | Country | Number | Kind | Date | |
|---|---|---|---|---|---|
| Patent | EP | 808617 | A2 | 19971126 | (Basic) |
| | EP | 808617 | A3 | 19980819 | |
| | EP | 808617 | B1 | 20050831 | |
| Application | EP | 97108111 | | 19970520 | |
| Priorities | DE | 19621269 | | 19960525 | |

Designated States:

34/5K/16 (Item 16 from file: 348) **Links**
EUROPEAN PATENTS

00791371
Endoprosthesis, in particular for the sterno-clavicular joint
Endoprothese, insbesondere fur das Sternum-Clavicular-Gelenk
Endoprothese, en particulier pour l'articulation sterno-claviculaire

Patent Assignee:

- Waldemar Link (GmbH & Co.); (297141)
  Barkhausenweg 10; 22339 Hamburg; (DE)
  (Proprietor designated states: all)

Inventor:

- Keller, Arnold
  An der Naherfurth 5; 23863 Kayhude; (DE)
- Keller, Arnold
  ; ;

Legal Representative:

- Glawe, Delfs, Moll & Partner (100698)
  Patentanwalte Liebherrstrasse 20; 80538 Munchen; (DE)

| | Country | Number | Kind | Date | |
|---|---|---|---|---|---|
| Patent | EP | 737454 | A1 | 19961016 | (Basic) |
| | EP | 737454 | B1 | 19991124 | |
| Application | EP | 96105593 | | 19960409 | |
| Priorities | DE | 29506419 | | 19950413 | |

34/5K/17 (Item 17 from file: 348) **Links**
EUROPEAN PATENTS

00753407
Device for positioning a hole in a bone
Vorrichtung zur Plazierung einer Bohrung in einem Knochen
Dispositif pour positionner un trou dans un os

Patent Assignee:

- GMT Gesellschaft fur medizinische Technik mbH; (502840)
  Holstenstrasse 2; 22767 Hamburg; (DE)
  (Proprietor designated states: all)
- Waldemar Link (GmbH & Co.); (297141)
  Barkhausenweg 10; 22339 Hamburg; (DE)
  (Proprietor designated states: all)

Inventor:

- Engelbrecht Edgar Dr.
  Andreasstrasse 33; 22301 Hamburg; (DE)
- Nieder Elmar Dr.
  Hinterdeich 117,; 21635 Jork; (DE)
- Keller Arnold
  An der Naherfurth 5; 23863 Kayhude; (DE)
- ...DE)
  ; ;
- Keller Arnold
  ; ;

Legal Representative:

- Glawe, Delfs, Moll & Partner (100691)
  Patentanwalte Rothenbaumchaussee 58; 20148 Hamburg; (DE)

| | Country | Number | Kind | Date | |
|---|---|---|---|---|---|
| Patent | EP | 709072 | A1 | 19960501 | (Basic) |
| | EP | 709072 | B1 | 20020502 | |
| Application | EP | 95115227 | | 19911129 | |
| Priorities | DE | 4038037 | | 19901129 | |

Designated States:

34/5K/18 (Item 18 from file: 348) **Links**
EUROPEAN PATENTS

00594733
Apparatus to unite bone fragments by means of a bone plate
Vorrichtung zum Verbinden von Knochenteilen mittels einer Knochenplatte
Dispositif de fixation de fragments osseux au moyen d'une plaque d'osteosynthese
Dispositif de fixation de fragments osseux au moyen d'une plaque d' osteosynthese

Patent Assignee:

- Waldemar Link GmbH & Co.; (297142)
  Barkhausenweg 10; 22339 Hamburg; (DE)
  (applicant designated states: AT;CH;DE;ES;FR;GB;IT;LI;SE)

Inventor:

- Eggers, Christoph, Dr.
  Bertha-Uhl-Kamp 33; D-22609 Hamburg; (DE)
- Keller, Arnold
  An der Naherfurth 5; D-23863 Kayhude; (DE)
- ...DE)
  ; ;
- Keller, Arnold
  ; ;

Legal Representative:

- Glawe, Delfs, Moll & Partner (100698)
  Patentanwalte Liebherrstrasse 20; 80538 Munchen; (DE)

| | Country | Number | Kind | Date | |
|---|---|---|---|---|---|
| Patent | EP | 600290 | A1 | 19940608 | (Basic) |
| | EP | 600290 | B1 | 19981014 | |
| Application | EP | 93118391 | | 19931112 | |
| Priorities | DE | 9216565 | | 19921204 | |

Designated States:

34/5K/19 (Item 19 from file: 348) **Links**
EUROPEAN PATENTS

00591491
Knee joint endoprosthesis for replacement of the tibial articular surfaces
Kniegelenkendoprothese zum Ersatz der Schienbein-Gelenkflachen
Endoprothese de l'articulation du genou pour le remplacement des surfaces articulaires tibiales
Knee joint endoprosthesis for replacement of the tibial articular surfaces

Patent Assignee:

- Waldemar Link (GmbH & Co.); (297141)
  Barkhausenweg 10; D-22339 Hamburg; (DE)
  (applicant designated states: CH;DE;ES;FR;GB;IT;LI;SE)

Inventor:

- Keller, Arnold
  An der Naherfurth 5; D-23863 Kayhude; (DE)
- Keller, Arnold
  ; ;

Legal Representative:

- Glawe, Delfs, Moll & Partner (100698)
  Patentanwalte Liebherrstrasse 20; 80538 Munchen; (DE)

| | Country | Number | Kind | Date | |
|---|---|---|---|---|---|
| Patent | EP | 589325 | A1 | 19940330 | (Basic) |
| | EP | 589325 | B1 | 19970521 | |
| Application | EP | 93114701 | | 19930913 | |
| Priorities | DE | 9212879 | | 19920924 | |

Designated States:

34/5K/20 (Item 20 from file: 348) **Links**
EUROPEAN PATENTS

00588858
Acetabular cup for a hip joint endoprosthesis
Gelenkpfanne fur eine Huftgelenk-Endoprothese
Coque acetabulaire pour une endoprothese de l'articulation de la hanche

Patent Assignee:

- Waldemar Link (GmbH & Co.); (297140)
  Postfach 63 05 52; D-22315 Hamburg; (DE)
  (applicant designated states: CH;DE;ES;FR;GB;IT;LI;SE)

Inventor:

- Keller, Arnold
  An der Naherfurth 5; D-23863 Kayhude; (DE)
- Keller, Arnold
  ; ;

Legal Representative:

- Glawe, Delfs, Moll & Partner (100692)
  Patentanwalte Postfach 26 01 62; 80058 Munchen; (DE)

| | Country | Number | Kind | Date | |
|---|---|---|---|---|---|
| Patent | EP | 588022 | A1 | 19940323 | (Basic) |
| | EP | 588022 | B1 | 19960925 | |
| Application | EP | 93111704 | | 19930721 | |
| Priorities | DE | 9212419 | | 19920915 | |

Designated States:
CH; DE; ES; FR; GB; IT; LI; SE;

34/5K/21 (Item 21 from file: 348) **Links**
EUROPEAN PATENTS

00563163
Intervertebral disc endoprosthesis
Bandscheibenendoprothese
Endoprothese pour disques intervertebraux
Intervertebral disc endoprosthesis

Patent Assignee:

- Waldemar Link (GmbH & Co.); (297140)
  Postfach 63 05 52; D-22315 Hamburg; (DE)
  (applicant designated states: AT;CH;DE;ES;FR;GB;IT;LI;SE)

Inventor:

- Buttner-Janz, Karin, Dr.
  Reetzer Weg 63; O-1144 Berlin; (DE)
- Keller, Arnold
  An der Naherfurth 5; W-2061 Kayhude; (DE)
- Lemaire, Jean-Philippe, Dr.
  Clinique de Fontaine, 1, rue des Creots; F-21121 Fontaine les Dijon; (FR)
- ...DE)
  ; ;
- Keller, Arnold
  ; ;

Legal Representative:

- Glawe, Delfs, Moll & Partner (100692)
  Patentanwalte Postfach 26 01 62; 80058 Munchen; (DE)

| | Country | Number | Kind | Date | |
|---|---|---|---|---|---|
| Patent | EP | 560141 | A1 | 19930915 | (Basic) |
| | EP | 560141 | B1 | 19961030 | |
| Application | EP | 93102993 | | 19930225 | |
| Priorities | DE | 4208116 | | 19920313 | |

Designated States:

34/5K/22 (Item 22 from file: 348) **Links**
EUROPEAN PATENTS

00516261
Bone plate device.
Knochenplattenanordnung.
Plaque osteosynthetique.
Plaque osteosynthetique.

Patent Assignee:

- Waldemar Link GmbH & Co; (297140)
  Postfach 63 05 52; D-22315 Hamburg; (DE)
  (applicant designated states: CH;DE;ES;FR;GB;IT;LI)

Inventor:

- Keller, Arnold
  An der Naherfurth 5; W-2061 Kayhude; (DE)
- Keller, Arnold
  ; ;

Legal Representative:

- Glawe, Delfs, Moll & Partner (100692)
  Patentanwalte Postfach 26 01 62; D-80058 Munchen; (DE)

| | Country | Number | Kind | Date | |
|---|---|---|---|---|---|
| Patent | EP | 507162 | A1 | 19921007 | (Basic) |
| | EP | 507162 | B1 | 19940309 | |
| Application | EP | 92104908 | | 19920320 | |
| Priorities | DE | 9104025 | | 19910403 | |

Designated States:

34/5K/23 (Item 23 from file: 348) **Links**
EUROPEAN PATENTS

00474399
Knee endoprosthesis
Kniegelenkendoprothese
Endoprothese de genou
Knee endoprosthesis

Patent Assignee:

- GMT Gesellschaft fur medizinische Technik mbH; (502840)
  Holstenstrasse 2; D-22767 Hamburg; (DE)
  (applicant designated states: CH;FR;GB;LI;NL;SE)
- Waldemar Link GmbH & Co.; (297142)
  Barkhausenweg 10; 22339 Hamburg; (DE)
  (applicant designated states: CH;FR;GB;LI;NL;SE)

Inventor:

- Engelbrecht, Eckart
  Andreasstrasse 33; W-2000 Hamburg 60; (DE)
- Nieder, Elmar
  Hinterdeich 117; W-2155 Jork; (DE)
- Keller, Arnold Karl Walter
  An der Naherfurth 5; 23863 Kayhude; (DE)
- ...DE)
  ; ;
- Keller, Arnold Karl Walter...
  ; ;

Legal Representative:

- Heldt, Gert, Dr. Dipl.-Ing. (5191)
  Neuer Wall 59 III; 20354 Hamburg; (DE)

| | Country | Number | Kind | Date | |
|---|---|---|---|---|---|
| Patent | EP | 488378 | A2 | 19920603 | (Basic) |
| | EP | 488378 | A3 | 19921202 | |
| | EP | 488378 | B1 | 19980520 | |
| Application | EP | 91120536 | | 19911129 | |
| Priorities | DE | 4038037 | | 19901129 | |

Designated States:

34/5K/24 (Item 24 from file: 348) **Links**
EUROPEAN PATENTS

00427956
Elbow endoprosthesis
Ellbogengelenk-Endoprothese
Endoprothese de coude

Patent Assignee:

- GMT Gesellschaft fur medizinische Technik mbH; (502840)
  Holstenstrasse 2; D-22767 Hamburg; (DE)
  (applicant designated states: CH;FR;GB;LI)
- Waldemar Link (GmbH & Co.); (297140)
  Postfach 63 05 52; D-22315 Hamburg; (DE)
  (applicant designated states: CH;FR;GB;LI)

Inventor:

- Engelbrecht, Eckart, Dr.med.
  Andreasstrasse 33; W-2000 Hamburg 60; (DE)
- Keller, Arnold
  An der Naherfurth 5; W-2061 Kayhude; (DE)
- ...DE)
  ; ;
- Keller, Arnold
  ; ;

Legal Representative:

- Heldt, Gert, Dr. Dipl.-Ing. (5191)
  Neuer Wall 59 III; D-20354 Hamburg; (DE)

| | Country | Number | Kind | Date | |
|---|---|---|---|---|---|
| Patent | EP | 493629 | A1 | 19920708 | (Basic) |
| | EP | 493629 | B1 | 19960515 | |
| Application | EP | 90125819 | | 19901231 | |
| Priorities | EP | 90125819 | | 19901231 | |

Designated States:

34/5K/25 (Item 25 from file: 348) **Links**
EUROPEAN PATENTS

00335591
Surgical instrument set.
Chirurgischer Instrumentensatz.
Jeu d'instruments chirurgical.

Patent Assignee:

- Waldemar Link GmbH & Co; (297140)
  Barkhausenweg 10; W-2000 Hamburg 63; (DE)
  (applicant designated states: DE;ES;FR;GB;IT;SE)

Inventor:

- Keller, Arnold
  An der Naherfurth 5; W-2061 Kayhude; (DE)
- Keller, Arnold
  ; ;

Legal Representative:

- Glawe, Delfs, Moll & Partner Patentanwalte (100693)
  Postfach 162 Liebherrstrasse 20; W-8000 Munchen 26; (DE)

| | Country | Number | Kind | Date | |
|---|---|---|---|---|---|
| Patent | EP | 333990 | A2 | 19890927 | (Basic) |
| | EP | 333990 | A3 | 19900509 | |
| | EP | 333990 | B1 | 19930721 | |
| Application | EP | 89101147 | | 19890123 | |
| Priorities | DE | 3809793 | | 19880323 | |

Designated States:

34/5K/26 (Item 26 from file: 348) **Links**
EUROPEAN PATENTS

00290592
Bone plate connected to the bone by means of an inclined screw.
Mit einem Knochen mittels einer schrag verlaufenden Schraube zu verbindende Platte.
Plaque d'osteosynthese connectee a l'os par une vis inclinee.
Bone plate connected to the bone by means of an inclined screw.
Plaque d'osteosynthese connectee a l'os par une vis inclinee.

Patent Assignee:

- Waldemar Link GmbH & Co; (297140)
  Barkhausenweg 10; W-2000 Hamburg 63; (DE)
  (applicant designated states: DE;ES;FR;GB;IT)

Inventor:

- Keller, Arnold
  An der Naherfurth 5; W-2061 Kayhude; (DE)
- Keller, Arnold
  ; ;

Legal Representative:

- Glawe, Delfs, Moll & Partner Patentanwalte (100691)
  Rothenbaumchaussee 58 Postfach 2570; W-2000 Hamburg 13; (DE)

| | Country | Number | Kind | Date | |
|---|---|---|---|---|---|
| Patent | EP | 299160 | A1 | 19890118 | (Basic) |
| | EP | 299160 | B1 | 19921119 | |
| Application | EP | 88107018 | | 19880502 | |
| Priorities | DE | 8709615 | | 19870713 | |

Designated States:

34/5K/27 (Item 27 from file: 348) **Links**
EUROPEAN PATENTS

00287923
Saddle prosthesis.
Sattelprothese.
Prothese en forme de selle.

Patent Assignee:

- GMT Gesellschaft fur medizinische Technik mbH; (502840)
  Holstenstrasse 2; D-22767 Hamburg; (DE)
  (applicant designated states: AT;CH;ES;FR;GB;LI)
- Waldemar Link GmbH & Co; (297140)
  Postfach 63 05 52; D-22315 Hamburg; (DE)
  (applicant designated states: AT;CH;ES;FR;GB;LI)

Inventor:

- Keller, Arnold
  An der Naherfurth 5; D-2061 Kaihude; (DE)
- Nieder, Elmar
  Hinterdeich 117; D-2155 York; (DE)
- Keller, Arnold
  ; ;

Legal Representative:

- Heldt, Gert, Dr. Dipl.-Ing. (5191)
  Neuer Wall 59 III; D-20354 Hamburg; (DE)

| | Country | Number | Kind | Date | |
|---|---|---|---|---|---|
| Patent | EP | 300131 | A2 | 19890125 | (Basic) |
| | EP | 300131 | A3 | 19891220 | |
| | EP | 300131 | B1 | 19931020 | |
| Application | EP | 88104296 | | 19880318 | |
| Priorities | DE | 3710233 | | 19870327 | |

Designated States:

34/5K/28 (Item 1 from file: 349) **Links**
PCT FULLTEXT

01455247
INTERVERTEBRAL PROSTHESIS COMPRISING SELF-TAPPING FIXING PROJECTIONS
PROTHESE INTERVERTEBRALE POURVUE DE STRUCTURES SAILLANTES DE FIXATION AUTOTARAUDEUSES
ZWISCHENWIRBELPROTHESE MIT SELBSTSCHNEIDENDEN FIXIERVORSPRUNGEN
INTERVERTEBRAL PROSTHESIS COMPRISING SELF-TAPPING FIXING PROJECTIONS

Patent Applicant/Patent Assignee:

- CERVITECH INC; 300 Roundhill Drive, Rockaway, NJ 07866
  US; US (Residence); US (Nationality)
  (For all designated states except: US)
- KELLER Arnold; An der Naherfurth 5, 23863 Kayhude
  DE; DE (Residence); DE (Nationality)

- KELLER Arnold;
  ; ;

Patent Applicant/Inventor:

- KELLER Arnold
  An der Naherfurth 5, 23863 Kayhude; DE; DE (Residence); DE (Nationality);
- KELLER Arnold
  ; ; ; ;

Legal Representative:

- GLAWE DELFS MOLL(agent)
  Rothenbaumchaussee 58, 20148 Hamburg; DE;

| | Country | Number | Kind | Date |
|---|---|---|---|---|
| Patent | WO | 2006136373 | A1 | 20061228 |
| Application | WO | 2006EP5910 | | 20060620 |
| Priorities | EP | 2005135177 | | 20050622 |

34/5K/29 (Item 2 from file: 349) **Links**
PCT FULLTEXT

01408895
METHOD FOR PRODUCING A MEDICAL IMPLANT MADE OF A BETA-TITANIUM MOLYBDENUM ALLOY, AND A CORRESPONDING IMPLANT
PROCEDE DE PRODUCTION D'UN IMPLANT MEDICAL EN ALLIAGE DE BETA-TITANE-MOLYBDENE ET IMPLANT CORRESPONDANT
VERFAHREN ZUM HERSTELLEN EINES MEDIZINISCHEN IMPLANTATS AUS EINER BETA-TITAN-MOLYBDAN-LEGIERUNG UND ENTSCHPRECHENDES IMPLANTAT

Patent Applicant/Patent Assignee:

- WALDEMAR LINK GMBH & CO KG; Barkhausenweg 10, 22339 Hamburg
  DE; DE (Residence); DE (Nationality)
  (For all designated states except: US)
- BALIKTAY Sevki; Spandauer Damm 119, 14050 Berlin
  DE; DE (Residence); DE (Nationality)
  (Designated only for: US)
- KELLER Arnold; An der Naherfurth 5, 23863 Kayhude
  DE; DE (Residence); DE (Nationality)
  (Designated only for: US)
- ...Designated only for: US);
  ; ;

- KELLER Arnold;
  ; ;

Patent Applicant/Inventor:

- BALIKTAY Sevki
  Spandauer Damm 119, 14050 Berlin; DE; DE (Residence); DE (Nationality); (Designated only for: US)
- KELLER Arnold
  An der Naherfurth 5, 23863 Kayhude; DE; DE (Residence); DE (Nationality); (Designated only for: US)
- ...Designated only for: US)
  ; ; ; ;
- KELLER Arnold
  ; ; ; ;

Legal Representative:

- GLAWE DELFS MOLL(agent)
  Patent- und Rechtsanwalte, Rothenbaumchaussee 58, 20148 Hamburg; DE;

| | Country | Number | Kind | Date |
|---|---|---|---|---|
| Patent | WO | 200689792 | A1 | 20060831 |
| Application | WO | 2006EP1792 | | 20060227 |
| Priorities | EP | 200541805 | | 20050225 |

34/5K/30 (Item 3 from file: 349) **Links**
PCT FULLTEXT

01398112

# CERVICAL INTERVERTEBRAL PROSTHESES
PROTHESES INTERVERTEBRALES CERVICALES
ZERVIKALE ZWISCHENWIRBELPROTHESEN
CERVICAL INTERVERTEBRAL PROSTHESES

Patent Applicant/Patent Assignee:

- CERVITECH INC; 300 Roundhill Drive, Rockaway, NJ 07866
  US; US (Residence); US (Nationality)
  (For all designated states except: US)
- KELLER Arnold; An der Naherfurth 5, 23863 Kayhude
  DE; DE (Residence); DE (Nationality)
  (Designated only for: US)
- KELLER Arnold;
  ; ;

Patent Applicant/Inventor:

- KELLER Arnold
  An der Naherfurth 5, 23863 Kayhude; DE; DE (Residence); DE (Nationality); (Designated only for: US)
- KELLER Arnold
  ; ; ; ;

Legal Representative:

- GLAWE DELFS MOLL(agent)
  Rothenbaumchaussee 58, 20148 Hamburg; DE;

| | Country | Number | Kind | Date |
|---|---|---|---|---|
| Patent | WO | 200679366 | A1 | 20060803 |
| Application | WO | 2005EP10081 | | 20050919 |
| Priorities | EP | 200515577 | | 20050126 |

34/5K/31 (Item 4 from file: 349) **Links**
PCT FULLTEXT

01350796

# PROSTHESIS FOR BRIDGING A VERTEBRAL BODY

PROTHESE DE PONTAGE D'UN CORPS VERTEBRAL
PROTHESE ZUR UBERBRUCKUNG EINES WIRBELKORPERS
PROSTHESIS FOR BRIDGING A VERTEBRAL BODY

Patent Applicant/Patent Assignee:

- CERVITECH INC; 300 Roundhill Drive, Rockaway, NJ 07866 US; US (Residence); US (Nationality)
  (For all designated states except: US)
- KELLER Arnold; An der Naherfurth 5, 23863 Kayhude DE; DE (Residence); DE (Nationality)
  (Designated only for: US)
- KELLER Arnold;
  ; ;

Patent Applicant/Inventor:

- KELLER Arnold
  An der Naherfurth 5, 23863 Kayhude; DE; DE (Residence); DE (Nationality); (Designated only for: US)
- KELLER Arnold
  ; ; ; ;

Legal Representative:

- GLAWE DELFS MOLL(agent)
  Rothenbaumchaussee 58, 20148 Hamburg; DE;

| | Country | Number | Kind | Date |
|---|---|---|---|---|
| Patent | WO | 200632311 | A1 | 20060330 |
| Application | WO | 2005EP6317 | | 20050613 |
| Priorities | EP | 2004226714 | | 20040923 |

34/5K/32 (Item 5 from file: 349) **Links**
PCT FULLTEXT

01265174

# CERVICAL PROSTHESIS AND INSTRUMENTS
PROTHESE CERVICALE ET INSTRUMENTS
ZERVIKALPROTHESE UND INSTRUMENTARIUM

Patent Applicant/Patent Assignee:

- CERVITECH INC; 300 Roundhill Drive, Rockaway, NJ 07866
  US; US(Residence); US(Nationality)
  (For all designated states except: US)
- LINK Helmut D; Wildstieg 14, 22397 Hamburg
  DE; DE(Residence); DE(Nationality)
  (Designated only for: US)
- KELLER Arnold; An der Naherfurth 5, 23863 Kayhude
  DE; DE(Residence); DE(Nationality)
  (Designated only for: US)
- MCAFEE Paul C; Scoliosis and Spine Center, 7505 Osler Drive, Suite 104, Baltimore, MD 21204
  US; US(Residence); US(Nationality)
  (Designated only for: US)
- ...Designated only for: US);
  ; ;
- KELLER Arnold;
  ; ;

Patent Applicant/Inventor:

- LINK Helmut D
  Wildstieg 14, 22397 Hamburg; DE; DE(Residence); DE(Nationality); (Designated only for: US)
- KELLER Arnold
  An der Naherfurth 5, 23863 Kayhude; DE; DE(Residence); DE(Nationality); (Designated only for: US)
- MCAFEE Paul C
  Scoliosis and Spine Center, 7505 Osler Drive, Suite 104, Baltimore, MD 21204; US; US(Residence); US(Nationality); (Designated only for: US)
- ...Designated only for: US)
  ; ; ; ;
- KELLER Arnold
  ; ; ; ;

Legal Representative:

- GLAWE Delfs Moll(agent)
  Patent- und Rechtsanwalte, Rothenbaumchaussee 58, 20148 Hamburg; DE;

| | Country | Number | Kind | Date |
|---|---|---|---|---|
| Patent | WO | 200572658 | A2-A3 | 20050811 |
| Application | WO | 2005EP458 | | 20050118 |
| Priorities | US | 2004768713 | | 20040202 |

34/5K/33 (Item 6 from file: 349) **Links**
PCT FULLTEXT

01225292

# CERVICAL INTERVERTEBRAL PROSTHESIS
PROTHESE INTERVERTEBRALE CERVICALE
ZERVIKALE ZWISCHENWIRBELPROTHESE
CERVICAL INTERVERTEBRAL PROSTHESIS

Patent Applicant/Patent Assignee:

- CERVITECH INC; 300 Roundhill Drive, Rockaway, NJ 07866
  US; US(Residence); US(Nationality)
  (For all designated states except: US)
- LINK Helmut; Wildstieg 14, 22397 Hamburg
  DE; DE(Residence); DE(Nationality)
  (Designated only for: US)
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| | Country | Number | Kind | Date |
|---|---|---|---|---|
| Patent | WO | 200532431 | A1 | 20050414 |
| Application | WO | 2004EP9089 | | 20040813 |
| Priorities | US | 2003690848 | | 20031002 |

34/5K/34 (Item 7 from file: 349) **Links**
PCT FULLTEXT

01211360

# INTERVERTEBRAL DISK PROSTHESIS
PROTHESE DE DISQUE INTERVERTEBRAL
BANDSCHEIBENPROTHESE
INTERVERTEBRAL DISK PROSTHESIS

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| | Country | Number | Kind | Date |
|---|---|---|---|---|
| Patent | WO | 200518508 | A1 | 20050303 |
| Application | WO | 2004EP6484 | | 20040616 |
| Priorities | EP | 200316441 | | 20030721 |

34/5K/35 (Item 8 from file: 349) **Links**
PCT FULLTEXT

01199970

# HIP PROSTHESIS PROVIDED WITH A SHAFT INSERTED INTO THE FEMUR

PROTHESE DE HANCHE COMPRENANT UNE TIGE A INSERER DANS L'OS DE LA CUISSE
HUFTPROTHESE MIT EINEM IN DEN OBERSCHENKELKNOCHEN EINZUSETZENDEN SCHAFT
HIP PROSTHESIS PROVIDED WITH A SHAFT INSERTED INTO THE FEMUR

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| | Country | Number | Kind | Date |
|---|---|---|---|---|
| Patent | WO | 200507039 | A1 | 20050127 |
| Application | WO | 2004EP6485 | | 20040616 |
| Priorities | EP | 200316157 | | 20030716 |

34/5K/36 (Item 9 from file: 349) **Links**
PCT FULLTEXT

01167427

# PROSTHETIC JOINT OF CERVICAL INTERVERTEBRAL DISCS

PROTHESE ARTICULAIRE DE DISQUE INTERVERTEBRAL CERVICAL
ZERVIKALE BANDSCHEIBEN-GELENKPROTHESE
PROSTHETIC JOINT OF CERVICAL INTERVERTEBRAL DISCS

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| | Country | Number | Kind | Date |
|---|---|---|---|---|
| Patent | WO | 200489259 | A1 | 20041021 |
| Application | WO | 2004EP1498 | | 20040217 |
| Priorities | EP | 20038127 | | 20030407 |

34/5K/37 (Item 10 from file: 349) **Links**
PCT FULLTEXT

01167418

# PROSTHETIC JOINT OF CERVICAL INTERVERTEBRAL FOR A CERVICAL SPINE
PROTHESE ARTICULAIRE INTERVERTEBRALE POUR LA COLONNE CERVICALE
ZWISCHENWIRBEL-GELENKPROTHESE FUR DIE HALSWIRBELSAULE
PROSTHETIC JOINT OF CERVICAL INTERVERTEBRAL FOR A CERVICAL SPINE

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| | Country | Number | Kind | Date |
|---|---|---|---|---|
| Patent | WO | 200489258 | A1 | 20041021 |
| Application | WO | 2004EP1029 | | 20040204 |
| Priorities | EP | 20038127 | | 20030407 |

34/5K/38 (Item 11 from file: 349) **Links**
PCT FULLTEXT

01113121

# SYSTEM OF INTERVERTEBRAL PROSTHESES

SYSTEME DE PROTHESES INTRA-VERTEBRALES
SYSTEM VON ZWISCHENWIRBELPROTHESEN
SYSTEM OF INTERVERTEBRAL PROSTHESES

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| | Country | Number | Kind | Date |
|---|---|---|---|---|
| Patent | WO | 200434935 | A1 | 20040429 |
| Application | WO | 2003EP2555 | | 20030312 |
| Priorities | DE | 10247762 | | 20021014 |
| | WO | 2003EP372 | | 20030115 |
| | US | 2003358387 | | 20030205 |

34/5K/39 (Item 12 from file: 349) **Links**
PCT FULLTEXT

01113118
INTERVERTEBRAL PROSTHESIS
PROTHESE INTERVERTEBRALE
ZWISCHENWIRBELPROTHESE
INTERVERTEBRAL PROSTHESIS

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| | Country | Number | Kind | Date |
|---|---|---|---|---|
| Patent | WO | 200434936 | A1 | 20040429 |
| Application | WO | 2003EP372 | | 20030115 |
| Priorities | DE | 10247762 | | 20021014 |

34/5K/40 (Item 13 from file: 349) **Links**
PCT FULLTEXT

01090862
KNEE PROSTHESIS
PROTHESE DU GENOU
KNIEPROTHESE
KNEE PROSTHESIS

Patent Applicant/Patent Assignee:

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| | Country | Number | Kind | Date |
|---|---|---|---|---|
| Patent | WO | 200412633 | A1 | 20040212 |
| Application | WO | 2003EP8196 | | 20030725 |
| Priorities | EP | 200216768 | | 20020726 |

34/5K/41 (Item 14 from file: 349) **Links**
PCT FULLTEXT

00972430

# COUPLED KNEE PROSTHESIS WITH A ROTATIONAL BEARING

PROTHESE DE GENOU COUPLEE ET PALIER DE ROTATION
GEKOPPELTE KNIEPROTHESE MIT ROTATIONSLAGER
COUPLED KNEE PROSTHESIS WITH A ROTATIONAL BEARING

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| | Country | Number | Kind | Date |
|---|---|---|---|---|
| Patent | WO | 200302039 | A2-A3 | 20030109 |
| Application | WO | 2002EP6900 | | 20020621 |
| Priorities | EP | 2001115511 | | 20010627 |

34/5K/42 (Item 15 from file: 349) **Links**
PCT FULLTEXT

00951565

# KNEE PROSTHESIS WITH A FLEXION HINGE

PROTHESE DU GENOU POURVUE D'UNE CHARNIERE DE FLEXION
KNIEPROTHESE MIT EINEM BEUGESCHARNIER
KNEE PROSTHESIS WITH A FLEXION HINGE

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| | Country | Number | Kind | Date |
|---|---|---|---|---|
| Patent | WO | 200285257 | A2-A3 | 20021031 |
| Application | WO | 2002EP4156 | | 20020415 |
| Priorities | EP | 2001110261 | | 20010425 |